

City Research Online

City St George's, University of London

Citation: Croft, S. (2008). Word-finding Difficulties in Bilingual Aphasia : Implications for Speech Language Therapy. (Unpublished Doctoral thesis, City University London)

This is the accepted version of the paper.

This version of the publication may differ from the final published version. To cite this item please consult the publisher's version.

Permanent repository link: https://openaccess.city.ac.uk/id/eprint/19638/

Copyright and Reuse: Copyright and Moral Rights remain with the author(s) and/or copyright holders. Copies of full items can be used for personal research or study, educational, or not-for-profit purposes without prior permission or charge, unless otherwise indicated, provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way. For full details of reuse please refer to City Research Online policy.

City Research Online: http://openaccess.city.ac.uk/ publications@citystgeorges.ac.uk

Word-finding Difficulties in Bilingual Aphasia: Implications for Speech and Language Therapy

Volume 1

Stephen Croft

Submitted in accordance with the requirements for the Doctor of Philosophy

The City University

Department of Language and Communication Science

December 2008

BRITISH LIBRARY

IMAGING SERVICES NORTH
Boston Spa, Wetherby
West Yorkshire, LS23 7BQ
www.bl.uk

THE FOLLOWING HAVE BEEN REDACTED AT THE REQUEST OF THE UNIVERSITY

VOLUME 1

P112 FIG 5.1, P233 FIGS 8.1,8.2,8.3

VOLUME 2

PHONE NUMBERS AND EMAIL ADDRESSES ON PAGES 39,44,46,118,121,124,126-7

Table of Contents

Volume 1
Abbreviations 10
Acknowledgements 11
Abstract 12
1 Introduction 13
2 Unilingual word finding and therapy 19
2.1 Introduction 19
2.2 Noun naming in unilingual speakers without brain-damage 19
2.2.1 The Snodgrass & Vanderwart (1980) picture set 19
2.2.2 Psycholinguistic variables as determinants of naming latency 21
2.2.3 Norms for picture sets in other languages 23
2.3 Word finding difficulties in unilingual speakers without brain injury 25
2.3.1 TOT states 25
2.3.2 Speech errors in people without brain injury 26
2.4 Unilingual word naming in aphasia 28
2.4.1 Assessment of word finding in aphasia 29
2.4.2 Factors affecting aphasic naming 31
2.4.2.1 Word frequency 31
2.4.2.2 Word length 32
2.4.2.3 Familiarity 32
2.4.2.4 Age of acquisition 33
2.4.2.5 Imageability 33
2.4.2.6 Operativity 34
2.4.2.7 Animacy 34
2.4.3 Classification of errors 35
2.4.3.1 Delay or failure to retrieve a word 36
2.4.3.2 Semantic errors 36
2.4.3.3 Phonological errors 36
2.4.3.4 Neologisms 38
2.4.3.5 Neologistic jargon aphasia 38
2.4.3.6 Semantically related circumlocutions 39
2.4.3.7 Mixed errors 39
2.4.3.8 Perseverative errors 40
2.4.3.9 Unrelated errors 41
2.5 The relationship between word finding errors of people with and without brain injury 41
2.6 Cognitive neuropsychological models of lexical processing 42
2.7 Dissociation of levels of breakdown in those with and without brain injury 47
2.7.1 Errors arising from CS module 48
2.7.2 Breakdown at the LS level 49
2.7.3 Breakdown in the POL 50
2.7.4 Errors where locus of breakdown is potentially multifactorial 52
2.8 Treatment of unilingual anomia 52
2.8.1 Short-term facilitation treatments 53
2.8.2 SLT targeting longer-term gains 55
2.8.3 Phonological versus semantic therapy 57
2.8.4 Generalisation of SLT gains 59
2.9 Summary 59
3 Bilingualism: Issues and ideas 61
3.1 What is bilingualism? 61

3.2 The impact of language acquisition history on second language ability 62
3.3 Attitudes towards bilingualism 64
3.4 Language versus dialect 65
3.5 Neuro-anatomical lateralisation of language processing 66
3.6 The bilingual lexicon 67
3.7 Interactive accounts of bilingual word processing 69
3.8 Picture naming in bilinguals without brain injury 74
3.9 Summary 77
4 Bilingual aphasia: Assessment and rehabilitation 78
4.1 Introduction 78
4.2 The "Laws" of Ribot and Pitres 78
4.3 Assessment of bilingual aphasia 79
4.3.1 Establishing pre-morbid history 79
4.3.2 Cultural bias and 'sensitivity' 81
4.3.3 Bias in assessment tasks and materials 82
4.3.4 Linguistic issues with bilingual assessment 84
4.3.5 Using and adapting existing aphasia tests 86
4.3.6 The Bilingual Aphasia Test 88
4.4 Working with bilingual coworkers and interpreters 89
4.5 Impairment and recovery in bilingual aphasia 91
4.5.1 Patterns of impairment in bilingual aphasia 91
4.5.1.1 Parallel impairment 91
4.5.1.2 Differential impairment 92
4.5.1.3 Differential aphasia 92
4.5.1.4 Blended or mixed pattern 93
4.5.1.5 Selective aphasia 93
4.5.2 Patterns of recovery in bilingual aphasia 94
4.5.2.1 Parallel recovery 94
4.5.2.2 Differential recovery 94
4.5.2.3 Successive recovery 95
4.5.2.4 Antagonistic recovery 95
4.5.2.5 Selective recovery 96
4.5.3 Factors impacting on recovery 96
4.6 Word finding difficulties in bilingual aphasia 99
4.7 Rehabilitation of bilingual aphasia 101
4.7.1 Treatment methods in bilingual aphasia 102
4.7.2 Choice of treatment language 104
4.7.3 Who carries out the therapy? 106
4.7.4 Cross-linguistic generalisation of therapy gains 107
4.8 Summary/review 109
5 The Bengali community in London 111
5.1 Introduction 111
5.2 The Bengali homeland 111
5.3 Historical importance of Bengali in Bangladesh 113
5.4 The Bengali language 114
5.5 Bengali phonology 115
5.5.1 Consonants 116
5.5.2 Vowels 117
5.5.3 Prosody 117
5.6 Dialects of Bengali 118
5.6.1 Standard Literary Bengali 118
5.6.2 Kolkata dialect 118
5.6.3 Dhaka dialect 118
5.6.4 Sylheti dialect 118
5.7 Sylhet Region 119

5.8 Bengali Emigration 120
5.9 The Bengali Community in the UK 122
5.9.1 Employment 123
5.9.2 Socio-economic position 123
5.9.3 Racism 124
5.9.4 L2 learning 125
5.9.5 Housing 126
5.9.6 Integration 127
5.9.7 Health and ageing 128
5.10 Implications for the project 132
5.11 Summary/review 134
6 Developing bilingual assessments of word finding 135
6.1 Introduction 135
6.2 Recruitment of Project Consultant 135
6.3 Recruitment and training of bilingual coworkers 137
6.4 Training of bilingual coworkers 138
6.5 Recruitment of non-brain-injured control group 138
6.6 Demography of control participants 140
6.6.1 Origin and migratory history of control participants 140
6.6.2 Age and gender of control participants 140
6.6.3 Language acquisition history of control participants 140
6.6.4 Language use of control participants 142
6.6.5 Education of control participants 145
6.6.6 Occupations of control participants 145
6.6.7 Summary of control group characteristics 146
6.7 Development of assessment materials 147
6.7.1 Selection of test targets 148
6.7.2 Screening by project consultant 149
6.7.3 Collection of word latency data 149
6.7.4 Analysing the data 152
6.8 Construction of aphasia tests 154
6.8.1 Oral naming test 155
6.8.2 Written naming test 156
6.8.3 Word repetition test 157
6.8.4 Spoken word to picture matching test 157
6.8.5 Written word to picture matching test 158
6.8.6 Test of reading aloud 158
6.9 Completion of control data collection 158
6.10 Review and summary 159
6.10.1 Consultant idiolect 160
6.10.2 Gender balance of coworker team 160
6.10.3 Difficulties of recruiting control participants 161
6.10.4 Discussion of latency data collection 162
7 An assessment of word finding difficulties in bilingual aphasia 165
7.1 Introduction 165
7.2 Obtaining ethical approval 165
7.3 Recruitment of aphasic participants 165
7.4 Aphasic participants 168
7.4.1 Saleha 169
7.4.2 Salma 170
7.4.3 Tarik 171
7.4.4 Rasheda 172
7.4.5 Azad 173
7.4.6 Asha 174
7.5 Collation of test battery 175
7.6 Administration protocol 177

7.7 Exploration of cueing 178
7.8 Collation of data 180
7.8.1 Spoken and written word to picture matching 180
7.8.2 Oral naming 180
7.8.3 Written naming 182
7.8.4 Reading aloud and word repetition 182
7.8.5 Pyramids and Palm Trees Test 182
7.9 Results 182
7.9.1 Saleha 191
7.9.2 Salma 195
7.9.3 Tarik 199
7.9.4 Rasheda 203
7.9.5 Azad 206
7.9.6 Asha 209
7.9.7 Effects of cueing on picture naming 210
7.10 Discussion 211
7.10.1 On recruitment 211
7.10.2 Cultural considerations 213
7.10.3 Assessment data 215
7.10.3.1 Cross-language differences 216
7.10.3.2 Semantic errors (input and output) 217
7.10.3.3 Interpretation of responses to cueing 221
7.10.4 Hypotheses for outcomes of word finding therapy 224
7.10.4.1 Predictions for outcomes of treatment for Saleha 226
7.10.4.2 Predictions for outcomes of treatment for Salma 226
7.10.4.3 Predictions for outcomes of treatment for Tarik 227
7.10.4.4 Predictions for outcomes of treatment for Rasheda 227
7.10.4.5 Predictions for outcomes of treatment for Azad 227
7.11 Summary and review 228
8 Treatment of word finding difficulties in bilingual aphasia 231
8.1 Introduction 231
8.2 Methodology 232
8.2.1 Identification of therapy targets 232
8.2.2 The design of the therapy study 234
8.2.2.1 Double baseline assessment 234
8.2.2.2 Allocation to treatment groups 235
8.2.2.3 Streaming of the five groups 236
8.2.3 Content and format of therapy sessions 237
8.2.3.1 Semantic tasks 238
8.2.3.1.1 Semantic associate matching 238
8.2.3.1.2 Functional targets 239
8.2.3.1.3 Naming to definition 239
8.2.3.1.4 Semantic feature analysis 239
8.2.3.2 Phonological tasks 239
8.2.3.2.1 Repetition of target in presence of picture 239
8.2.3.2.2 Phonological cueing task 239
8.2.3.2.3 Rhyme judgement task 240
8.2.3.2.4 Syllable counting task 240
8.2.3.2.5 Initial phoneme judgement task 240
8.2.4 Contrasts between Bengali and English treatment sessions 240

8.2.5 Reassessments following treatment 241
8.3 Results 242
8.3.1 Outline of data analysis strategy 244
8.3.2 Saleha 246
8.3.3 Salma 246
8.3.4 Tarik 247
8.3.5 Rasheda 248
8.3.6 Azad 249
8.3.7 Case series analysis 250
8.3.7.1 Naming of control items 250
8.3.7.2 Results of therapy delivered in Bengali 251
8.3.7.2.1 Bengali semantic therapy 251
8.3.7.2.2 Bengali phonological therapy 252
8.3.7.2.3 Cross-linguistic generalisation to English following Bengali semantic therapy 253
8.3.7.2.4 Cross-linguistic generalisation to English following Bengali phonological therapy 253
8.3.7.3 Results of therapy delivered in English 254
8.3.7.3.1 English semantic therapy 254
8.3.7.3.2 English phonological therapy 254
8.3.7.3.3 Cross-linguistic generalisation to Bengali following English semantic therapy 255
8.3.7.3.4 Cross-linguistic generalisation to Bengali following English phonological therapy 256
8.3.7.4 Severity of aphasia as an indicator of therapy outcomes 256
8.3.7.5 Response to cueing as an indicator of therapy outcomes 258
8.3.8 Summary of results 260
8.4 Discussion 261
8.4.1 Did treatment have more beneficial effects in one language and how did this relate to baseline performance? 261
8.4.2 Under what circumstances did treatment effects generalise to the untreated language? 263
8.4.3 Can a participant's responses to cueing be taken as an indication of potential to improve with SLT? 266
8.4.4 How successful was the process of carrying out SLT with unqualified bilingual coworkers? 267
8.4.5 How effective was the methodology for this phase of the project? 271
8.5 Summary and review 273
9 Word finding difficulties in bilingual aphasia: Conclusions 275
9.1 Introduction 275
9.2 Restatement of the need for this research 275
9.3 Reviewing the research questions addressed by the project 276
9.3.1 Is word production similarly impaired in languages in a sample of people with bilingual aphasia? 276
9.3.2 Is word finding improved by speech and language therapy and do effects generalise to the untreated language? 280
9.3.3 Do therapy outcomes depend on the nature of the treatment? 281
9.4 Implications for clinical practice 283

9.5 Directions for future research 285
9.6 Final thoughts 288

Volume 2
References 2
Appendix 1: Information sheet for control participants (English) 38
Appendix 2: Information sheet for control participants (Bengali) 40
Appendix 3: Control participant consent form (English) 43
Appendix 4: Control participant consent form (Bengali) 45
Appendix 5: Language acquisition history questionnaire 47
Appendix 6: Control participant naming response marking sheet (English) 50
Appendix 7: Control participant naming response marking sheet (Bengali) 53
Appendix 8: Collated control participant latency data: name agreement and pair-matched items 57
Appendix 9: Paired t-test data for control participant naming latencies 60
Appendix 10: Picture stimuli for naming tests 62
Appendix 11: Oral naming test (English with semantic cues) 70
Appendix 12: Oral naming test (English with cross-linguistic cues) 71
Appendix 13: Oral naming test (Bengali with semantic cues) 72
Appendix 14: Oral naming test (Bengali with cross-linguistic cues) 73
Appendix 15: Written naming test (English) 74
Appendix 16: Written naming test (Bengali) 75
Appendix 17: Word repetition test (English) 76
Appendix 18: Word repetition test (Bengali) 77
Appendix 19: Spoken word to picture matching test (English) 78
Appendix 20: Spoken word to picture matching test (Bengali) 79
Appendix 21: Picture stimuli for spoken word to picture matching tests 80
Appendix 22: Written word to picture matching test (English) 112
Appendix 23: Written word to picture matching test (Bengali) 113
Appendix 24: Written stimuli for written word to picture matching and reading aloud tests (English) 114
Appendix 25: Written stimuli for written word to picture matching and reading aloud tests (Bengali) 114
Appendix 26: Test of reading aloud (English) 115
Appendix 27: Test of reading aloud (Bengali) 116
Appendix 28: Information sheet for aphasic participants (English) 117
Appendix 29: Information sheet for aphasic participants (Bengali) 119
Appendix 30: Aphasic participant consent form (English) 122
Appendix 31: Aphasic participant consent form (Bengali) 125
Appendix 32: Therapy targets with lexical variables for the five aphasic participants 128
Appendix 33: Graphs indicating therapy phase naming scores for the five aphasic participants 146

Tables

Table 2.1: Languages for which norms have been collected using the Snodgrass & Vanderwart (1980) set 24
Table 2.2: Examples of speech errors classified by speech unit and error mechanism 28
Table 2.3: Examples of various cueing strategies 54
Table 3.1: Some definitions of bilingualism reflecting a range of proficiency 62
Table 5.1: Inventory of Bengali consonants 116
Table 5.2: Inventory of Bengali vowels 117

Table 6.1: Control data for spoken word to picture matching and oral naming tests for both Bengali and English 159
Table 7.1: Contents of the battery of tests for aphasic participants 176
Table 7.2: Control data for spoken word to picture matching and oral naming tests for both Bengali and English 183
Table 7.3: Scores in Bengali for all aphasic participants 184
Table 7.4: Scores in English for all aphasic participants 185
Table 7.5: Scores on the PALPA tests for all aphasic participants 186
Table 7.6: Scores on the Pyramids and Palm Trees test for all aphasic participants 186
Table 7.7: Comparison of scores for novel tests in English versus PALPA equivalents 186
Table 7.8: Breakdown of uncued oral naming responses 187
Table 7.9: Breakdown of uncued written naming responses 188
Table 7.10: Breakdown of reading aloud test responses 188
Table 7.11: Breakdown of word repetition test responses 189
Table 7.12: Breakdown of test errors comparing 'high' versus 'low' frequency groups 190
Table 7.13: Collated oral naming test scores and code-switching errors for aphasic participants 191
Table 7.14: Saleha's test battery scores 192
Table 7.15: Salma's test battery scores 196
Table 7.16: Tarik's test battery scores 199
Table 7.17: Rasheda's test battery scores 203
Table 7.18: Azad's test battery scores 206
Table 7.19: Asha's test battery scores 210
Table 7.20: Summary of cueing effects on picture naming for all aphasic participants 211
Table 7.21: Collated input and output semantic errors for aphasic participants 220
Table 8.1: Tasks used in treatment for all participants in both languages 237
Table 8.2: Correct naming responses for all five assessments for aphasic participants 243
Table 8.3 Results from McNemar tests addressing questions of the analysis strategy 245
Table 8.4: Naming scores and gain scores for aphasic participants 257
Table 8.5: Pearson P-M correlation analysis for naming scores versus therapy gain scores 258
Table 8.6: Cueing scores (%) for aphasic participants 259
Table 8.7: Pearson P-M correlation analysis for phonemic cue scores versus therapy gain scores 259

Illustrations

Figure 2.1: The 'Cookie jar theft' picture 29
Figure 2.2: A serial model of levels of processing for naming a line drawing 43
Figure 2.3: An example of how the word production process may result in multiactivation of semantic nodes 45
Figure 2.4: Interactive activation model of word production 46
Figure 3.1: Green's (1986) serial model of bilingual word processing 69
Figure 3.2: An interactive schematic representation of lexical and sublexical access 71
Figure 3.3: SOPHIA: Semantic, Orthographic, and Phonological Interactive Activation model of word recognition 73
Figure 5.1: Map of Bangladesh 112
Figure 6.1: Birthplaces of control participants 140

Figure 6.2:	Control participants' grading of spoken English	141
Figure 6.3:	Other languages spoken by control participants	141
Figure 6.4:	Age when control participants first learned English (both oral and written)	142
Figure 6.5:	Control participant uses of Bengali	143
Figure 6.6:	Control participant uses of English	143
Figure 6.7:	Control participant frequency of speaking Bengali	143
Figure 6.8:	Control participant frequency of speaking English	143
Figure 6.9:	Control participant grading of reading Bengali	143
Figure 6.10:	Control participant grading of reading English	143
Figure 6.11:	Control participant frequency of reading Bengali	144
Figure 6.12:	Control participant frequency of reading English	144
Figure 6.13:	Control participant grading of Bengali writing	144
Figure 6.14:	Control participant grading of English writing	144
Figure 6.15:	Control participant frequency of writing Bengali	145
Figure 6.16:	Control participant frequency of writing English	145
Figure 6.17:	Other languages learned or used at school by control participants	145
Figure 6.18:	Occupations of control participants after completion of education	146
Figure 7.1:	Age and ration of pre- and post-onset life of aphasic participants at time of consent	169
Figure 7.2:	Saleha's self-rating of pre-morbid language abilities	170
Figure 7.3:	Salma's self-rating of pre-morbid language abilities	171
Figure 7.4:	Tarik's self-rating of pre-morbid language abilities	172
Figure 7.5:	Rasheda's self-rating of pre-morbid language abilities	173
Figure 7.6:	Azad's self-rating of pre-morbid language abilities	174
Figure 7.7:	Asha's self-rating of pre-morbid language abilities	175
Figure 8.1:	London bus	233
Figure 8.2:	Bangladeshi bus	233
Figure 8.3:	Jackfruit	233
Figure 8.4:	Graphic representation of the procedure for the SLT phase of the project	234
Figure 8.5:	Graph indicating aphasic participants' naming of control items in Bengali at T1 and T5	251
Figure 8.6:	Graph indicating aphasic participants' naming of control items in English at T1 and T5	251
Figure 8.7:	Graph indicating aphasic participants' naming of items in Bengali receiving semantic therapy in Bengali	252
Figure 8.8:	Graph indicating aphasic participants' naming of items in Bengali receiving phonological therapy in Bengali	252
Figure 8.9:	Graph indicating aphasic participants' naming of items in English receiving semantic therapy in Bengali	253
Figure 8.10:	Graph indicating aphasic participants' naming of items in English receiving phonological therapy in Bengali	253
Figure 8.11:	Graph indicating aphasic participants' naming of items in English receiving semantic therapy in English	254
Figure 8.12:	Graph indicating aphasic participants' naming of items in English receiving phonological therapy in English	255
Figure 8.13:	Graph indicating aphasic participants' naming of items in Bengali receiving semantic therapy in English	255
Figure 8.14:	Graph indicating aphasic participants' naming of items in Bengali receiving phonological therapy in English	256

Abbreviations

AoA	Age of acquisition
BAT	Bilingual Aphasia Test
BIA	Bilingual Interactive Activation model
BNT	Boston Naming Test
CS	Conceptual semantics
CVA	Cerebrovascular accident
EMILLE	Enabling Minority Language Engineering
L1	First language
L2	Second language
LS	Lexical semantics
NHS	National Health Service
PALPA	Psycholinguistic Assessments of Language Processing in Aphasia
POL	Phonological output lexicon
RCSLT	Royal College of Speech and Language Therapists
SCB	Standard Colloquial Bengali
SOAS	School of Oriental and African Studies
SOPHIA	Semantic, Orthographic, and Phonological Interactive Activation model
SLT	Speech and language therapy/therapist
TOT	Tip of the tongue
UNESCO	United Nations Educational, Scientific, and Cultural Organisation

Acknowledgements

The guidance received from my supervisors Prof. Jane Marshall and Prof. Tim Pring is gratefully acknowledged. This supervision was supplemented by a project steering group attended by Suzanne Marsello, Matthew Hardwick, and Katerina Hilari, whose contributions helped shape the project. Thanks also to Michael Coleman, who allowed me to use his own latency calculation programme and also offered a user tutorial.

Sharifun Ahmed, Nasrin Begum, and Rowshan Ara Khanam offered advice regarding cultural issues when working with members of the Bengali community in the UK. Salma Begum, Tarik Khan, and Zahir Choudhury all provided essential assistance in their roles as Bilingual Coworkers. Thanks also to Claire Harries for proofreading the dissertation.

Without the participants, both with and without aphasia, who willingly gave their time without payment, there would be no project to report here. Finally, the funding of this project by Barts and the London NHS Trust is gratefully acknowledged.

I grant powers of discretion to the University Librarian to allow this thesis to be copied in whole or in part without further reference to me. This permission covers only single copies made for study purposes, subject to normal conditions of acknowledgement.

Abstract

Anomia is a common symptom of aphasia in both unilingual and bilingual speakers (Kohn & Goodglass, 1985; Stadie, Springer, de Bleser, & Bürk, 1995). In cases of bilingual aphasia, a key question is whether word finding is equally affected in both languages. This has implications both for models of bilingual lexical access and for rehabilitation. Although aphasia in bilingual language users has attracted considerable research attention, few rehabilitation studies have been conducted with this group (Roberts, 1998; Fabbro, 1999). As a result, clinicians lack evidence on which to base decisions when working with bilingual clients (Roberts, 2001).

This study reports the process of assessing and treating word finding difficulties in a group of bilingual speakers of Bengali and English with aphasia. The study also reports the process of developing tests of word finding suitable to be carried out with this population. The main questions were:

1. Is word production similarly impaired across languages in a sample of people with bilingual aphasia?
2. Is word finding improved by speech and language therapy and do effects generalise to the untreated language?
3. Do therapy outcomes depend on the nature of the treatment?

The data suggest that differential impairments are rare or difficult to identify. Most participants performed equally across the two languages, although two participants showed some evidence of such an impairment, in that they named, or responded to cues, more successfully in L2 than L1.

Findings show that therapy can improve naming in some bilinguals with aphasia, both in L1 and L2. They also show that therapy delivered through bilingual co-workers can be beneficial. Not all participants benefited from treatment, but evidence of positive outcomes from both semantic and phonological therapy for at least some participants is reported. Only semantic therapy brought about gains that generalised to the untreated language.

1 Introduction

The study of lexical retrieval can be placed at the heart of psycholinguistic enquiry. Over the past half-century, a great deal of attention has been given to picture naming in unilingual speakers of numerous languages. This attention continues to grow as our understanding of factors that impact on word production develops. Models of lexical retrieval have also become increasingly complex and refined, as they have been developed to account for growing data collected from people both with and without brain injury. Indeed, there is an increasing recognition that models of language processing must also take into account the performance of people with brain injury (Ellis & Young, 1996).

Anomia, or word finding difficulties, is a common symptom of aphasia (Kohn & Goodglass, 1985; Bates & Goodman, 1997; Davis, 2000). Indeed, the various errors that people with aphasia make when attempting to produce a word has had a strong influence on the structure of various models of lexical retrieval and the differentiation of semantic versus phonological processing. Unsurprisingly, studies of the rehabilitation of aphasia have mirrored the large amount of attention given to picture naming and lexical retrieval; there have been many studies of the treatment of word finding difficulties in aphasia. This also reflects the clinical practice of speech and language therapists (SLTs) working with aphasia, as treating word finding difficulties is a common therapy target (Whitworth, Webster, & Howard, 2005). People with aphasia often respond positively to SLT targeting word finding difficulties. Even though SLTs can not yet reliably pair a therapy task with a particular language impairment and predict an outcome, the numerous treatment studies of anomia have yielded robust evidence of effective outcomes of SLT in this area (perhaps more so than for any other type of aphasic impairment) (Nickels, 2002).

But what of people who speak more than one language? The overwhelming majority of studies of word finding in people both with and without brain injury have been unilingual (or at least, participants have been presumed to be unilingual). However, at least a third (Wei, 2000) and possibly a majority (Grosjean, 1982; de Groot & Kroll, 1997) of the world's population is bilingual. Although the study of bilingualism has been

marginalised for many years, there is an increasing awareness of the need to address this imbalance. However, although studies exploring bilingualism and bilingual aphasia are growing in number, very little attention has been given to the treatment of bilingual aphasia. This paucity of evidence for SLT is reflected in Fabbro's (1999) textbook introducing areas of study in the field of bilingual neuropsychology. His chapter on rehabilitation amounts to little more than a page. Both Roberts (2001) and Paradis (2001) have identified the need for more studies exploring the assessment and treatment of bilingual aphasia. The Royal College of Speech and Language Therapists (RCSLT) (2005) recognises that bilingualism is an advantage and that all individuals have a right to access SLT and receive treatment in their first language (L1), regardless of their ethnic background. However, as evidence for treating bilinguals with language difficulties remains limited, these ideals remain difficult to implement (Stokes, Thakaria, & MacLeod, 1999).

In a world where migration (for various reasons) is becoming increasingly commonplace, numbers of bilingual people will continue to grow. This is compellingly the case in London, where recent estimates suggest that over 300 languages other than English are spoken as a L1 (London Research Centre, 2000). As a result, SLTs practising in London will inevitably encounter bilingual clients. As the majority of SLTs in the UK are unilingual English speakers, encountering bilingual clients is often a source of anxiety and feelings of helplessness (Stow, 2004). Consequently, Devi (2002) suggests that SLTs perform poorly when working with clients with whom they do not share languages. Although the need to address these difficulties in paediatric SLT services has been recognised for some time (e.g. Duncan, 1989; Winter, 1999), treatment of bilingual adults with language disabilities remains underdeveloped.

One example of a large ethnic minority community in London is the Bangladeshi community, which is based largely around the Whitechapel area of the London Borough of Tower Hamlets. A recent census indicated that 34% of the total population of Tower Hamlets is Bengali (National Statistics, 2001b); this proportion is also growing quickly

(City University Press Archive, 2002). Naturally, a large proportion of this community will be bilingual speakers of Bengali and English, even though some first generation migrants may only have learned limited English. Barts and the London NHS Trust (the funders of the current study) provide healthcare in Tower Hamlets, and health professionals working in this area will often encounter Bengali people in their clinical practice. Consequently, the Trust has generated a growing number of studies exploring a wide range of health issues within this community, including acute myocardial infarction (Barakat, Wells, Ramdhany, Mills, & Timmis, 2003), diabetes (Vaughan, 2005), and premature ejaculation (Steggall, 2005).

To my knowledge, no studies of the treatment of bilingual aphasia have been carried out with members of the Bengali community. This is partly because studying bilingual aphasia is, frankly, difficult. Developing bilingual assessment materials that are valid tests of the two languages is complex, especially (as in the current situation) when one of the target languages is not spoken by the researcher. Likewise, carrying out assessment and treatment of aphasia in a language not spoken by the SLT remains an underdeveloped area of enquiry. Word finding difficulties, a common symptom of aphasia in unilingual speakers, are also common in bilingual aphasia (Stadie, Springer, de Bleser, & Bürk, 1995). Consequently, this study will describe a project that carried out assessment and treatment of word finding difficulties in bilingual aphasia with people from London's Bengali community.

This study sets out to address three main research questions:

1. Is word production similarly impaired in languages in a sample of people with bilingual aphasia?

In cases of bilingual aphasia, a key question is whether word finding is equally affected in both languages. This has implications both for models of bilingual lexical access and for therapy. A number of patterns are possible. For example, there may be equal performance across languages, or an unequal performance reflecting acquisition history. Alternatively, there may be unequal performance that indicates a differential

impairment. To date, the evidence suggests that differential impairments are less common than a balanced recovery that reflects pre-morbid abilities (Paradis, 2001). No aphasia tests are currently available for bilingual speakers of Bengali and English; therefore in order to explore this question, it was necessary to develop tests of word retrieval that were valid, reliable and well-matched across those languages. Responses to cueing can also offer an indication of the severity of a language impairment (Howard, Patterson, Franklin, Orchard-Lisle, & Morton, 1985a); therefore in addition to assessing unaided picture naming and analysing errors, aphasic participants' responses to various cueing techniques were also explored.

2. Is word finding improved by speech and language therapy and do effects generalise to the untreated language?

Aphasic participants who demonstrated word finding difficulties in the assessment phase received treatment targeting those difficulties. Participants received two blocks of treatment, one in English, and one in Bengali, the latter being carried out in collaboration with bilingual coworkers. This allowed the exploration of whether therapy in one language elicits a greater improvement in picture naming than the other. It also allowed the exploration of the process of carrying out aphasia therapy with non-specialist bilingual coworkers, an area that has received very little attention. Another issue of clinical relevance is whether (and if so, where) cross-linguistic generalisation occurs. There are important clinical implications if evidence indicates that therapy carried out in one language (e.g. the participant's L1) results in gains that are more likely to generalise to the untreated language than therapy carried out in the other language.

3. Do therapy outcomes depend on the nature of the treatment?

A great deal of the research exploring the treatment of word finding difficulties with unilingual people with aphasia has indicated that some types of therapy tasks can result in longer lasting gains than others. The classic differentiation here is between semantic (where tasks focus on the meaning of the target) and phonological therapy (where the focus is on the sound structure of the target) (e.g. Howard *et al.*, 1985a). Both

types of tasks can result in long lasting gains in unilingual people with aphasia, although there is no shortage of contrasting evidence (this will be reviewed in Chapter 2). It is important to establish whether different types of therapy can result in different outcomes with people with bilingual aphasia. One type of therapy might result in gains that are longer lasting than the other. Likewise, gains from one type of treatment might be more likely to generalise to the untreated language. Again, there may be theoretical implications here. If gains from semantic therapy show greater generalisation to the untreated language than those from phonological therapy, this would support models of bilingual language processing (such as de Bot, 1992; de Groot, 1992; Smith, 1997) that argue for the dissociation of a centralised semantic module and language-specific phonological lexicons.

This dissertation takes the form of eight further chapters. Chapters 2-5 form a review of areas pertinent to the current study. Chapter 2 reviews the literature available regarding word finding in unilingual speakers both with and without aphasia and considers current evidence regarding therapy for anomia. Chapter 3 examines some issues that need to be considered when working with bilingual speakers, while Chapter 4 reviews previous studies of bilingual aphasia and discusses some difficulties that may be faced when assessing and treating bilingual people with aphasia. All participants in the current study were members of the Bengali community in London; therefore Chapter 5 considers the language, culture, and socio-economic background of this community.

Chapters 6-8 report the methodology and results of the current study. Chapter 6 reports the process of developing a battery of aphasia tests suitable to be carried out with members of the Bengali community in London. Chapter 7 offers assessment data collected from six bilingual people with aphasia collected using the battery developed in Chapter 6. Chapter 8 reports the process of carrying out SLT targeting word finding difficulties with bilingual participants with aphasia. Chapters 6-8 all include ongoing discussion and review of the findings presented in these sections, while Chapter 9 ties

together the project, discusses its overall implications, and makes suggestions for future research.

2 Unilingual word finding and therapy

2.1 Introduction

Before considering bilingual word processing, it is necessary to review what is known about word finding in unilinguals, both in people without brain injury and those with aphasia. Given that there may be more bilingual than unilingual people in the world, it would be reasonable to suggest that bilingual language research should be the dominant field and unilingual research its natural offshoot. However, the opposite is the reality. Although interest in bilingualism is certainly growing, the study of unilingual language is by far the dominant field. Consequently, bilingual research has been very strongly influenced by advances in unilingual research. This chapter will review areas relevant to the current study, including lexical processing and speech errors in people with and without brain injury, and review some evidence for the effectiveness of SLT to improve word finding difficulties in unilingual people with aphasia.

2.2 Noun naming in unilingual speakers without brain-damage

Over the last half-century, a great deal of academic endeavour has focused on exploring unilingual speakers' responses to picture naming tasks. Indeed, single word processing is one of the most commonly studied aspects of language. Clearly, understanding, retrieving and producing nouns are fundamental building blocks of communication and consequently worthy of academic exploration, but compared to many other areas of language, single word studies are comparatively feasible. Confrontation naming allows researchers a high expectation of the target response and of possible alternatives. Studies beyond the single word level become more difficult to control. Likewise, it is possible to control for a number of psycholinguistic variables in single word studies, whereas controlling sentence production tasks is more problematic.

2.2.1 The Snodgrass & Vanderwart (1980) picture set

In 1980, Snodgrass & Vanderwart published a group of 260 black and white line drawings of objects in response to a need for a fixed set of pictures to be used in psychological experiments. Before then, researchers had generally formulated their own

picture stimuli; therefore there was a great deal of variation in stimuli for each study, and their results were not necessarily comparable or certainly less easy to compare. Indeed, there is some evidence that photographs and colour pictures may be more complex than black and white line drawings to process or, at least, are processed differently (see Ostergaard & Davidoff, 1985; Biederman & Ju, 1988; Price & Humphreys, 1989). There was a need for a standard set of pictures that could potentially form the stimuli for a large number of studies. Snodgrass & Vanderwart collected normative data for their pictures from 219 psychology students who were native speakers of American English. Data for 4 largely independent variables were collected:

- Name agreement – consistency of name elicited from the subjects.
- Image agreement – a rating of the subjects' comparison of the picture to their mental image of that object.
- Familiarity – a rating of how usual or unusual each subject found each object in their realm of experience.
- Visual complexity – a rating of the amount of detail contained in the picture (not how complex the object is that it represents).

The authors also included previously published data for age of acquisition (AoA) (Carroll & White, 1973ab) and written word frequency (Kuĉera & Francis, 1967) for each item in the set. Carroll & White's data consist of subjective ratings by adults of the estimated age that they learned each word. The authors argue that this is a reliable method for measuring word learning age and provide evidence demonstrating a strong correlation between AoA ratings and normative data collected directly from children. Their position has subsequently been supported by Lyons, Teer, & Rubenstein (1978), Gilhooly & Gilhooly (1980), Walley & Metsala (1990), and Morrison, Chapell, & Ellis (1997). Kuĉera & Francis' (1967) written word frequency database is essentially a count of how many times each word appears in a corpus of written English consisting of one million words. Snodgrass & Yuditsky (1996) supplemented these norms with mean naming latencies for the set.

2.2.2 Psycholinguistic variables as determinants of naming latency

Standardised picture sets have been used in a large number of psycholinguistic studies exploring a range of areas, such as perceptual identification and recognition (Kroll & Potter, 1984; Snodgrass & Corwin, 1988), and priming studies investigating the effects of prior exposure to fragmented words (Snodgrass & Poster, 1992) or fragmented pictures (Feenan & Snodgrass, 1990). However, for the current study, the focus is on picture naming, an area that has received a great deal of attention. Are all words equally easy to retrieve and produce (especially when using object line drawings as stimuli) or are some words more difficult to produce than others? The methodologies that researchers have used to obtain these data will also be considered.

One way of determining how difficult a word is to retrieve is to measure the time it takes to produce the target in response to a stimulus, typically an object picture or the written word. This reaction time, otherwise known as word latency, is essentially the time that passes between the presentation of the stimulus and the onset of the target word. Native speaker picture naming latencies are typically between 300 and 3000 milliseconds (Snodgrass & Yuditsky, 1996; Barry, Morrison, & Ellis, 1997). Indeed, individual latencies outside this range are generally excluded from mean data on the grounds of either anticipation of the stimulus or an occurrence of a word finding difficulty. With such a wide range of latencies, especially when taken as mean latencies from a large group of subjects, it is clear that some words take longer to retrieve and produce than others. A key question (one that has occupied psycholinguists since the 1960s) is which variables account for this difference, i.e. what is it that makes one word more difficult to name than another? The six variables included in the Snodgrass & Vanderwart (1980) paper (outlined in Section 2.2.1), plus word length (e.g. the number of phonemes in the word) have most commonly, but not exclusively, been given consideration.

Oldfield & Wingfield (1965) presented evidence suggesting that word frequency is a major determinant of latency, especially when naming pictures (as opposed to reading latencies; see also Lotto, Rumiati, & Job, 1996). Indeed, many more recent studies have

provided evidence supporting this position (e.g. Goodglass, Theurkauf, & Wingfield, 1984; Monsell, Doyle, & Haggard, 1989; Jescheniak & Levelt, 1994; Griffin & Bock, 1998).

However, the validity of this evidence has been questioned. Indeed, as early as 1973, Carroll & White (1973ab) suggested that the word frequency effect could in fact be accounted for by AoA, a variable which was not always taken into account in the above studies. They also published adult ratings of AoA for a large number of words collected from speakers of American English. The authors argue (and this was later supported by Morrison *et al.*, 1997) that adult AoA ratings correlate highly with actual children's naming performance. This relationship between word frequency and AoA is not unexpected – children are more likely to learn words that they regularly hear (i.e. high frequency words) than words that they hear infrequently. In any case, Morrison, Ellis, & Quinlan (1992) re-examined Oldfield & Wingfield's (1965) data including three variables in their analysis: Carroll & White's (1973b) AoA ratings, Kučera & Francis' (1967) written word frequencies, and word length (number of phonemes). All three variables were highly correlated to naming latencies (which of course in itself does not indicate a causal effect). Multiple regression analysis indicated that only AoA was a significant determinant of word latency. In the same paper, Morrison *et al.* also presented (British English) latency data they collected themselves using items from the Snodgrass & Vanderwart (1980) set. In addition to word frequency, AoA, and word length (phonemes), they also included imageability and prototypicality ratings (both from Quinlan, 1992). Multiple regression analysis indicated that only AoA and word length had significant independent effects on word naming. Word frequency showed no independent effect on latency; therefore the data lend support to those who argue for the importance of AoA for determining word latency (e.g. Carroll & White, 1973ab; Gilhooly & Gilhooly, 1980). This evidence supporting an effect of AoA but not word frequency was also replicated in French (Bonin, Chalard, Méot, & Fayol (2002), Icelandic (Ind & Tryggvadottir, 2002), Italian (Dell'Acqua, Lotto, & Job, 2000) and Spanish (Sanfeliu & Fernandez, 1996).

Although the evidence regarding the role of word frequency as a determinant of naming latency has become more ambiguous, the 'strong' position taken by some researchers (such as Carroll & White, 1973b; Morrison *et al.*, 1992) that the original word frequency effects were in fact AoA effects 'in disguise' remains unproven. Barry *et al.* (1997) analysed picture naming latencies collected from speakers of British English as part of a study collecting normalised data for the Snodgrass & Vanderwart (1980) set. In addition to the six variables analysed by Snodgrass & Vanderwart (1980), Barry *et al.* (1997) included three further variables in their analysis: Word length (number of phonemes), imageability, and the interaction of word frequency and AoA. In their multiple regression analysis, they found a significant effect of word frequency, name agreement, and the interaction of word frequency and AoA. When AoA ratings were substituted in the analysis for objective AoA data collected from children (Morrison *et al.*, 1997), this variable also showed a significant independent effect. These data, while supporting the evidence of an AoA effect in naming latencies, also provide support for an independent role of word frequency. The key to why word frequency is significant with these data could be because Barry *et al.* (1997) took their frequency data from a database of spoken words (Baayen, Piepenbrock, & Gulikers, 1995), as opposed to the written frequencies of the commonly used Kuĉera & Francis (1967) database. It is possible that this is better suited to analysis of spoken naming data.

2.2.3 Norms for picture sets in other languages

There is no evidence to suggest that norms collected in one language can be applied to other languages (Reales, Ballesteros, & Garcia, 2002). As the Snodgrass & Vanderwart (1980) set has been so influential, norms have been collected from unilingual speakers of a number of languages (see Table 2.1). Others have either added a large number of additional pictures to the set (in French: Alario & Ferrand, 1999) or developed an entirely new set (in Italian: Dell'Acqua *et al.*, 2000).

Most studies have been carried out in Western countries with Indo-European languages, the exceptions being Chinese and Japanese. Although it was possible that the

task of naming a picture might not have successfully crossed cultures, none of these studies reported a practical difficulty with carrying out the task itself. Likewise, when word latency data were collected (in American English: Snodgrass & Yuditsky, 1996; in British English: Barry *et al.*, 1997; and in Italian: Dell'Acqua *et al.*, 2000), there were no reports of difficulties or objections to the practicalities of computerised presentation of the stimuli or having to wear a microphone. There is, however, little evidence indicating how people from non-Western cultures might accept such a task.

Language	Reference
Chinese	Chen, Yen, Tsai, & Yeh (2001) Weekes, Shu, Hao, Liu, & Tan (2007)
Dutch	Martein (1995)
English (British)	Barry, Morrison, & Ellis (1997)
French	Bonin, Chalard, Méot, & Fayol (2002) Alario & Ferrand (1999)
Icelandic	Ind & Tryggvadottir (2002) Pind, Jonsdottir, Gossuradottir, & Jonsson (2000)
Italian	Nisi, Longoni, & Snodgrass (2000)
Japanese	Joshikawa & Inui (1986)
Spanish (Mexican)	Aveleyra, Gomez, Ostosky-Solis, & Rigatt (1996)
Spanish (Spanish)	Reales, Ballesteros, & Garcia (2002) Cuetos, Ellis, & Alvarez (1999) Sanfeliu & Fernandez (1996)

Table 2.1: Languages for which norms have been collected using the Snodgrass & Vanderwart (1980) set.

The Snodgrass & Vanderwart (1980) set was originally collated for use within an American context; therefore there will inevitably be some items that do not work well in other languages and cultures. Obvious examples in the set include 'baseball bat' and 'football helmet', which were often removed from studies re-norming the set in other languages. However, where norms have been collected in a format that can be compared to the original data, there are generally surprisingly high correlations (Alario & Ferrand, 1999), even though there may be some small but significant differences for some rated variables (including image agreement, familiarity, and visual complexity: Sanfeliu & Fernandez, 1996; Cuetos *et al.*, 1999; Pind *et al.*, 2000). Alario & Ferrand (1999) also

compared differences in the *H* statistic (a measure of name agreement that takes into account the number of different alternatives produced by subjects). They found that Snodgrass & Vanderwart's (1980) data had bigger *H* values than their French data, as well as Sanfeliu & Fernandez's (1996) Spanish data. This indicates that English responses were in fact more variable than those in French and Spanish, despite the fact that the stimuli were originally developed for use in English. However, given that English has an unusually large range of vocabulary (because of the influences of both Germanic and Romance languages), this variability is not altogether surprising.

Dell'Acqua *et al.* (2000) compared multiple regression analysis of determinants of naming speed from their own study with the two other studies that have collected equivalent data (Snodgrass & Yuditsky, 1996; Barry *et al.*, 1997). AoA and the *H* statistic were significant determinants of naming speed for all three studies. Name agreement was only significant in the two studies of English, while concept agreement was significant for all but Barry *et al.* (1997). Word frequency was only a significant variable for Barry *et al.* (1997), but this may be because only this study used spoken word frequencies (as opposed to written). Familiarity and word length were non-significant in all studies.

In summary, studies that have collected norms for the Snodgrass & Vanderwart set in languages other than English have shown that these items can be employed successfully in alternative cultures. Furthermore, very similar findings emerge with respect to the influence of lexical variables. However, most data are derived from Western cultures and are therefore unable to inform the current study.

2.3 Word finding difficulties in unilingual speakers without brain injury

Although the current study does not focus on spontaneous speech production, it is important to acknowledge that word finding difficulties feature in normal production either as 'tip-of-the-tongue (TOT) state', or in the production of a speech error.

2.3.1 TOT states

Most people can recall a situation where they found themselves unable to recall a word. They might be able to describe what they mean, or be able to identify some

phonological characteristics of the word (such as the number of syllables or the first sound of the word) but are unable to complete retrieval and actually produce the word. This is often accompanied by "feelings of knowing" (Harley, 1995:246) and the sense that the word is 'coming', although access is often completed hours later when the word comes 'out of nowhere'. This phenomenon is known as a TOT state and was first examined experimentally by Brown & McNeill (1966), who found that they were able to induce a TOT state in participants by reading a definition of a low frequency noun and asking them to name it. They also discovered that during a TOT state, some subjects were able to produce phonologically similar real words (e.g. target: sextant, produced: 'secant', 'sextet', 'sexton') generally unrelated in meaning. This indicates that word retrieval is not an all or nothing process – it is possible to know the meaning of a word without being able to access fully its phonological form (see also Burke, MacKay, Worthley, & Wade, 1991). Likewise, Vigliocco, Antonini, & Garrett (1997) discovered that Italian speakers in a TOT state can also often identify the grammatical gender of the target noun. Section 2.6 will explore how TOT states fit in to models of word retrieval, but for now it suffices to acknowledge this difficulty is commonly encountered in speakers without brain injury.

2.3.2 Speech errors in people without brain injury

The speech of people without brain injury is not error-free. Indeed, speech errors, otherwise known as slips of the tongue, are commonly encountered (Harley, 1995). Rev. Dr. William Spooner, a dean of Oxford University, became infamous for his speech errors, so much so that the term 'Spoonerism' has become widely used to describe the types of speech errors he apocryphally made – transpositions of word initial phonemes of two words that often (but not always) resulted in real word errors, e.g. target: 'You missed my history lecture'; produced: 'You hissed my mystery lecture'; target: 'Is the Dean busy?', produced: 'Is the bean dizzy?' (Robinson, 2006). The debate regarding Dr. Spooner continues. His college (University of Oxford, 2006) suggests that despite having had a number of verbal idiosyncrasies, he probably never uttered a "spoonerism".

Conversely, some authors (e.g. Potter, 1980) have suggested that he may actually have had mild aphasia.

The term Freudian slip has also entered the mainstream as a way of describing word errors that reveal repressed thoughts. One of Freud's (1901, cf. Harley, 1995) examples was made by a professor during a lecture: 'In the case of female genitals, in spite of many *Versuchungen* (temptations) – I beg your pardon, *Versuche* (experiments)...". However, most spontaneous errors do not have such an overtly sexual theme. Indeed, Motley & Baars (1979) suggest that there is a mechanism that suppresses errors that would result in a sexual innuendo. Such a slip will be labelled here as a phonological error, as the produced word is phonologically similar to the target.

However, non-aphasic errors are not only phonological. People without brain damage also make semantic errors, i.e. where the word produced is related in meaning to the intended word. This often occurs during TOT states, where people produce a series of words semantically related but distinct from the target which are then rejected as incorrect. For example, using a similar method to induce TOT states as Brown & McNeil (1966), Davies (1984, cf. Ellis & Young, 1996) gave subjects a definition of low frequency words and asked them to name it (target: wharf, produced: "Dock, jetty, no, oh no, I know it, berth, dock, oh no, no, I do know it but it's not gonna come"). People without brain damage also produce semantic errors in spontaneous speech as slips of the tongue, although they are also often spontaneously corrected (e.g. "Three, five and eight are the worst years for *beer* – I mean *wine*"; "The room is too damn *hot – cold*..." (Fromkin, 1980, cf. Ellis & Young, 1996).

In fact, speech errors occur at all linguistic levels up to and including the sentence level in people without brain damage. That is, errors can occur at the level of phonological feature, phoneme, syllable, morpheme, word, phrase or sentence. Note that errors need not result in the production of real words in the language spoken, although there is a bias towards producing real words (Baars, Motley, & MacKay, 1975; Levelt,

1989). Table 2.2 presents a summary of speech errors from Harley's (1995) corpus collected from non-brain-injured speakers, and is consistent with the earlier categorisations of speech errors of Fromkin (1973) and Cutler (1982).

Type	**Linguistic level**	**Utterance**	**Target**
Perseveration	Phonological feature Phoneme	Turn the kno*p* God rest *re* merry gentlemen	knob ye
Exchange	Phoneme Morpheme Word	Do you *reel feally* bad? I *randomed* some *samply* Guess whose *mind* came to *name*?	feel really bad I sampled some randomly whose name came to mind
Anticipation	Phoneme	The *m*irst of May	first
Deletion	Phoneme Affix	Backgound lighting The chimney cat*ch* fire	background catches
Blend	Word Phrase	The *chung* of today Miss you *a very much*	children + young very much + a great deal
Substitution	Word	Get me a *fork*	spoon

Table 2.2: Examples of speech errors classified by speech unit and error mechanism (Harley 1995).

2.4 Unilingual word naming in aphasia

Having established the distinction between semantic and phonological errors in the speech of people without brain injury, some of the literature exploring word finding errors of unilingual people with aphasia will now be reviewed. The possibility that a relationship exists between the errors of people with and without aphasia will also be considered.

An appropriate starting point in this review of aphasic naming is Paradis' (1995a) observation that people with global aphasia – those whose language impairment is so severe they are unable to demonstrate any language comprehension and expression – retain the ability to control concepts at the non-linguistic level. That is, aphasia is a disturbance of language, and does not necessarily result in other cognitive disorders, although it co-occurs with other cognitive disorders (e.g. of attention, memory and perception) which may also impact on a language disability (Luria, 1966; Kohnert, 2004). In the absence of damage to other cognitive systems, non-linguistic conceptual representation remains intact. A patient with aphasia might not be able to demonstrate

comprehension of the word 'cup' or produce it, but s/he will retain the ability to recognise and use one appropriately in the absence of other cognitive disturbance. It is also germane to note at this point that word finding difficulties are almost ubiquitous in aphasia, and can also be one of its most frustrating symptoms (Nickels, 2002).

2.4.1 Assessment of word finding in aphasia

Assessments of aphasic word finding have typically drawn on the methodology used with people without brain injury. That is, the aphasic patient or participant is shown a number of line drawings to name (typically either from or designed in the style of the black and white line drawings from the Snodgrass & Vanderwart, 1980, set). Initial informal SLT assessments often include the naming of real objects (Bray, Ross & Todd, 1999), but this is generally only carried out as a screening involving a small number of items, as carrying out a test involving a larger number of actual objects is clearly unwieldy and impractical. Observations and analysis of spontaneous speech samples usually indicate the presence of a difficulty with word finding (Whitworth *et al.*, 2005; Saffran, Berndt, & Schwartz, 1989), but error analysis of spontaneous speech data alone may be difficult in the case of severe impairments, as the target words may not be immediately apparent. Some tests have sought to overcome this difficulty by collecting samples of connected speech using stimuli where the targets can often be anticipated, such as describing the situation presented in a line drawing (e.g. the 'Cookie jar theft', from the Boston Diagnostic Aphasia Examination, see Figure 2.1, Goodglass & Kaplan, 1972), or including a task where the patient retells a well known story, such as Cinderella (Berndt, Wayland, Rochon, Saffran, & Schwartz, 2000).

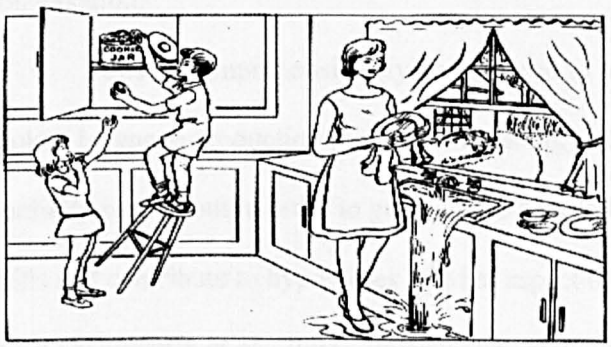


Figure 2.1: The 'Cookie jar theft' picture (Goodglass & Kaplan, 1972).

However, most studies and clinical assessments of word finding focus on single words. This allows the tester much greater control of the stimuli and provides a clear expectation of anticipated responses to which actual responses can be compared. Additionally, tests at the single word level facilitate the control of the various psycholinguistic variables outlined in Section 2.2.2. Although some researchers have developed object picture naming tests for their own use (e.g. Feyereisen, Van der Borght & Seron, 1988; Hirsh, 1998), many studies have employed widely used published tests such as the Boston Naming Test (BNT) (Kaplan, Goodglass & Weintraub, 1983) and the Psycholinguistic Assessments of Language Processing in Aphasia (PALPA, Kay, Lesser & Coltheart, 1992). Use of these tests has the advantages of providing data in the same format as a number of previous studies, and normalised data from people without brain injury are generally available, although care must be taken here as norms do not always apply to different cultural communities, even when the same language is spoken (Kerr, 1993).

The picture naming paradigm has been criticised. Lebrun & Buyssens (1982) point out that naming tests are metalinguistic tasks. That is, a test of picture naming is likely to be an artificial task for most adults and is different in nature from spontaneous speech. The authors suggest that naming test performance need not necessarily reflect a patient's spontaneous spoken skills. However, when developing their assessment of word finding in aphasic spontaneous speech, Hickin, Best, Herbert, Howard & Osborne (2001) found that aphasic picture naming and scores on their conversation measure were highly correlated; therefore it is possible that picture naming can reflect word finding skills in conversation.

Tests of comprehension (typically word to picture matching) and other aspects of spoken language production (i.e. tests of reading aloud and word repetition) are also normally carried out in order to gain a more detailed profile of the patient's language skills and contribute to hypotheses of what aspect of language processing is breaking down (Whitworth *et al.*, 2005). Indeed, tests of naming and comprehension can be carried

out using the same words and pictures as targets, thereby helping to pinpoint where in the word retrieval process breakdown is occurring.

2.4.2 Factors affecting aphasic naming

Studies exploring the psycholinguistic variables that impact on word naming in people without brain injury were reviewed in Section 2.2.2. Research investigating variables that impact on naming in aphasia has largely mirrored this progress of studies of naming in people without brain injury. A difficulty of exploring naming in aphasia is that language breakdown can be multifactorial and errors that appear to be similar may in fact result from different disorders (Shallice, 1988). As aphasia is such a multifaceted disorder, even the most apparently robust effects of a particular variable are not exhibited by all aphasic participants – it appears that in aphasia there will always be contrasting evidence. Indeed, many of the variables explored are intercorrelated, and it is difficult to unravel effects of individual variables (Gilhooly & Watson, 1981; Nickels & Howard, 1995a). These variables are not the focus of the current study. Exploring the impact of variables on unilingual naming is already highly contested, with many claims and counter claims. Chapter 4 clarifies the difficulties of exploring psycholinguistic variables with bilingual speakers. As the aim of the current chapter is to reflect research in the field of unilingual word naming, a brief discussion of these variables is included, even though they will not be the focus of the current study.

Nickels (1997) outlines seven variables that have been claimed to have an effect on aphasic naming:

2.4.2.1 Word frequency

Just as in non-brain-injured participants, word frequency was once considered to have robust effects on aphasic naming. A number of studies found a relationship between word frequency and the ability of aphasic participants to produce that word in a confrontation naming task. Most studies reporting a word frequency effect found that high frequency words were more likely to be named than low frequency words (e.g. Newcombe, Oldfield, & Wingfield, 1965; Butterworth, Howard, & McLoughlin, 1984;

Howard, Patterson, Franklin, Morton, & Orchard-Lisle, 1984). However, Marshall, Pring, Chiat, & Robson (2001) reported a case study of an aphasic person who demonstrated an inverse frequency effect, i.e. high frequency words were less likely to be named than low frequency words.

As the effects of word frequency in people without brain injury came increasingly into question, so too did these data from aphasic people. Not all aphasic participants in later studies demonstrated a robust effect of word frequency that could be reliably distinguished from intercorrelation with other variables (Howard *et al.*, 1984; Caramazza & Hillis, 1990; Nickels & Howard, 1995b). However, word frequency is often used as a variable in aphasia naming tests to ensure that test targets include a range of difficulties (e.g. test 54 of the PALPA, Kay *et al.*, 1992).

2.4.2.2 Word length

After word frequency, word length (either number of phonemes or syllables) has often been reported to have a consistent effect on aphasic naming. Several studies have reported cases where naming deteriorates as the word length of the target increases (Ellis, Miller, & Sin, 1983; Caplan, 1987; Cuetos, Aguado, Izura, & Ellis, 2002). However, although errors increase with word length in most cases in the literature (Nickels, 1997), not all aphasic people show a word length effect in naming (Kay & Ellis, 1987), and there are also occasional individuals who show an inverse effect (e.g. Best, 1995).

2.4.2.3 Familiarity

Funnell & Sheridan (1992) suggest that an aphasic participant's familiarity with a target should be given consideration in addition to word frequency in object naming tasks. However, this remains an underdeveloped area, and Nickels (1997) notes that different authors have used different definitions of this when collecting ratings data, including familiarity with the written word (Gernsbacher, 1984), regularity of contact with or thinking about the item (Snodgrass & Vanderwart, 1980), and regularity of hearing or producing the word (Gilhooly & Logie, 1980). The impact of familiarity on aphasic naming remains unclear, although Brown & Watson (1987) note that familiarity is highly

correlated with word frequency; therefore it may be difficult to show an independent effect of familiarity on word naming.

2.4.2.4 Age of acquisition

Section 2.2.2 referred to the growing awareness of the impact of AoA in word naming in people without brain injury. The 'strong' position taken by some researchers (Carroll & White 1973ab; Morrison *et al.*, 1992) that word frequency effects were in fact AoA effects 'in disguise' has not emerged in studies of aphasic naming. In their study of word naming in a group of 18 aphasic participants, Feyereisen *et al.* (1988) found that both word frequency and AoA (as well as picture familiarity ratings) were significant predictors of word naming, although a high intercorrelation existed between these variables. However, the authors argue that there is an effect of AoA independent of word frequency; therefore it appears to be the case that one variable is not simply a substitute for the other. AoA effects independent of word frequency have subsequently also been reported by Hirsh & Ellis (in a single case study, 1994) and Nickels & Howard (in 8 of their 15 aphasic participants, 1995b). Weekes, Davies, Parris, & Robinson (2003) reported a case study of a person with aphasia acquired after suffering herpes simplex viral encephalitis who demonstrated a significant independent effect of AoA on word spelling.

2.4.2.5 Imageability

The imageability of the target item has been reported to have an effect on the performance of *some* brain-injured participants in a number of tasks, including synonym matching (Franklin, 1989), reading aloud (Coltheart, Patterson & Marshall, 1980; Berndt, Haendiges, Burton & Mitchum, 2002), word repetition (Howard & Franklin, 1988) and sentence completion (Berndt *et al.*, 2002). Almost by definition, the targets in a picture naming task need to be highly imageable. However, Nickels & Howard (1995b) reported an independent effect of imageability on the picture naming of two of their aphasic participants. That is, the more imageable the target, the more likely the item would be successfully named.

2.4.2.6 Operativity

Gardener (1973; 1974) reported evidence of an independent effect of what he termed operativity on aphasic naming. Operativity concerns how manipulable and discrete an item is, e.g. items such as book and pen would be considered highly operative. This contrasts with items that are normally only visually experienced (e.g. wall, cloud): Such items would be deemed to have low operativity.

Operativity as a concept remains unclear, and has not received a great deal of attention with regards to aphasic naming. Feyereisen *et al.* (1988) found a significant effect of operativity on aphasic naming, although this was not significant when AoA and familiarity were taken into account. However, their definition of operativity was slightly different to Gardener's; therefore their ratings data may not represent quite the same concept as Gardener's original work. Indeed, when including operativity ratings using Gardener's definition of the concept as a variable in their study, Nickels & Howard (1995b) found an independent effect of operativity on aphasic naming, albeit only for a minority of their participants.

2.4.2.7 Animacy

A number of cases of aphasia have been reported where animacy of the target item has impacted on aphasic naming. In most cases where animacy has been reported to have an independent effect on naming, inanimate items were named more often than animate targets. Most of these cases became aphasic following contracting herpes simplex (Warrington & Shallice, 1984; Silveri & Gainotti, 1988; Stewart, Parkin, & Hunkin, 1992; De Renzi & Lucchelli, 1994). However, a smaller (although growing) number of cases have been reported that indicate an impairment to accessing inanimate items (e.g. Warrington & McCarthy, 1987; Sacchett & Humphreys, 1992; Moss & Tyler, 1997; Laiacona & Capitani, 2001). These latter cases, it should be noted, acquired aphasia through CVAs or degenerative conditions rather than viral illnesses. Inevitably, cases have been also reported where animacy has no independent effect on word naming (Stewart *et al.*, 1992; Funnell & Sheridan, 1992). However, in their review of the

evidence for category-specific impairments, Capitani, Laiacona, Mahon, & Caramazza (2003) found that many studies did not present data that could be statistically or theoretically interpreted. Consequently, they concluded that evidence for the existence of category specific anomia was not very strong.

2.4.3 Classification of errors

Anomia is a complex and multifarious impairment. There are a number of different types of word finding error an aphasic person can make, although in many ways these are similar to the errors made by people without brain injury outlined in Section 2.3.2. However, not all aphasic people make all types of error. Consequently, studies exploring the profile of errors that appear in a number of cases of aphasia can inform our understanding of the language processing in people both with and without aphasia. The various types of word finding errors made by people with aphasia will be described before considering recent theories and models that try to account for these breakdowns. Whitworth *et al.* (2005) outline five categories of aphasic word finding errors:

1. Delay or failure to retrieve a word
2. Semantic errors
3. Phonological errors
4. Neologisms
5. Semantically related circumlocutions

Three more categories not included by Whitworth *et al.* (2005) can be added:

6. Mixed errors
7. Perseverative errors
8. Unrelated errors

These error categories will form the basis of the error classification of naming responses for the current study. For bilingual naming, extra categories must also be included to accommodate code switching and mixed language errors. This issue will be revisited in the next chapter, where studies exploring bilingual picture naming will be considered.

2.4.3.1 Delay or failure to retrieve a word

Word retrieval failure is commonly encountered in aphasia (Kohn & Goodglass, 1985) and has been described as the "hallmark of aphasia" (Beeson, Holland & Murray, 1995:135). Indeed, early studies of aphasia (such as Potts, 1901) described cases who presented with the classic symptoms of word finding difficulties. When asked to name an object, they were often unable to name it, although they often insisted that they knew the name but were unable to produce it and demonstrated that they had recognised the object by gesturing, drawing, or describing its use. They also recognised the correct name when hearing it spoken.

2.4.3.2 Semantic errors

The term semantic error applies to errors that are related in meaning to the target word (e.g. target: saucer, response: 'cup') and are commonly encountered in wide range of aphasia disorders (Rinnert & Whitaker, 1973). However, it is possible to subdivide aphasic semantic errors into a number of further error types. Coltheart (1980) makes the distinction between coordinate and associative errors. A coordinate semantic error is one that not only shares some semantic features with the target but also shares a hypernym (or superordinate) with the target (e.g. target: swan, response: 'robin', hypernym: bird). This contrasts with associative errors, where although the target and response may share some semantic features (or associations), they do not share a hypernym (e.g. target: racquet, response: 'tennis'). Beeson *et al.* (1995) further distinguish two more types of associative error. They differentiate errors where the target's hypernym is produced (e.g. target: robin, response: 'bird') from those where an attribute of the target is produced (e.g. target: robin, response: 'red breast').

2.4.3.3 Phonological errors

Coding an aphasic naming error as phonological is more complex than may first appear. Clearly, if an aphasic person produces a response that is phonologically similar to the target (e.g. target: racquet, response: /sækɪt/), one can certainly contrast it to one that is semantically related to the target (e.g. 'bat'). These errors often conform to phonotactic

rules of the target language (Blumstein, 1978) and the target and error phoneme are often articulatorily and acoustically similar (Nespoulous, Joanette, Ska, Caplan, & Lecours, 1987; Valdois, Joanette, Nespoulous, & Poncet, 1988). However, aphasic errors that may be phonological are not always as easy to classify as the above example. It is necessary to establish what constitutes a response that is phonologically related to the target, i.e. how many phonemes (and in what order) does a response have to have in common with the target to be considered phonologically related? For example, how should the response /ru:bəl/ to the target 'racquet' be coded? The word initial phoneme is correct, and the response contains the same number of phonemes as the target, yet none of the other phonemes is correct. Unfortunately, there is no obvious solution to this difficulty, and phonological relatedness depends on what criteria one decides to implement in error coding. This is further complicated when different researchers use different criteria to define a phonological error. For example, Nickels & Howard (1995b) code errors as phonological that share 50% of phonemes in approximately the same order with the target, but Martin, Dell, Saffran, & Schwartz (1994) employ a less stringent criterion and classify a response that shares just one phoneme (excluding schwas) with the target. Consequently, care must be taken when considering data acquired by researchers using different classification criteria. For the current study, Nickels & Howard's (1995b) criterion for phonological errors was used for error coding.

Phonological errors that result in a real word (e.g. target: basket, response: 'biscuit') are known as formal paraphasias (Nickels, 1997). Phonologically related real word errors have generally been considered as resulting from chance (although see Blanken (1990), who presents a case who made a high number of formal paraphasic errors and argues these cannot all be due to chance).

2.4.3.4 Neologisms

The terminological dispute regarding phonological errors described in the previous section results in confusion when distinguishing a neologism from a phonological error. Indeed, some researchers (such as Butterworth, 1979, 1985; Miller & Ellis, 1987) consider phonological errors to be a subcategory of neologisms. However, the basis for the format of the current review follows the classification schema of Whitworth *et al.* (2005), who define (p.51) a neologism as a non-word response that shares insufficient phonemes with the target to be considered a phonological error (e.g. target: queen, response: /rɒblɪ/, from Harley, 1995), although they do not specify how many phonemes are 'sufficient'.

As with phonological errors, neologisms have been shown to comply with the phonotactic constraints of the language and tend not to contain non-native phonemes (Butterworth, 1979; Christman, 1994; Hanlon & Edmundson, 1996; Robson, Pring, Marshall, & Chiat, 2003), although exceptions have been reported (Peuser & Temp, 1981; Cappa, Miozzo, & Frugoni, 1994). For the current study, non-word errors were coded as neologisms when they failed to fulfil Nickels & Howard's (1995b) criteria for coding phonological errors.

2.4.3.5 Neologistic jargon aphasia

The above section on neologisms only addresses single word errors, and although accurate, provides only an incomplete account of neologisms in aphasia. Neologistic speech errors are found in a number of different aphasic disorders (Gainotti, Silveri, Villa, & Miceli, 1986), but not all neologistic errors take the form of a single non-word error. Consider the following response to an object naming task (target: telephone) reported by Butterworth (1979): "Oo that, that sir. I show you then what is a /zækprɪks/ for the /elenkɒm/, with the /pɪdləmz/ has an /aijɪn/ - one, two, three and so on and the /ædrʌm/ can be correct to /sus/ taken. But it's a – a thing of document". This patient also produces neologistic errors, but his response starkly contrasts to the single non-word response

given as an example of a neologism in the previous section. Here, speech is fluent and copious (indeed, excessive) but characterised by neologistic speech errors, and consequently very difficult for a listener to understand. This severe communication impairment is known as neologistic jargon aphasia, and contrasts with semantic jargon aphasia, where speech is equally copious but characterised by the production of real word errors. The present study will not explore jargon aphasia, but it was considered relevant to contrast single non-word errors with the production of neologistic jargon (see also the reviews of jargon aphasia by Butterworth, 1985; and Marshall, 2006).

2.4.3.6 Semantically related circumlocutions

When experiencing a word finding difficulty, some people with aphasia produce a description or circumlocution outlining some semantic characteristics of the target word, thereby demonstrating intact (or partly intact) access to the semantic representation of the target when access to the phonological form is unavailable (Whitworth *et al.*, 2005). One of the aphasic cases described by Caramazza & Hillis (1990) made a high proportion of semantic circumlocutions in both sentence repetition (e.g. target: 'The Chinese fan had a rare emerald', response: 'The Chinese fan had a stone in it ... I can't think of the name but it's the colour of grass'), and object picture naming tasks (e.g. target: anchor, response: 'What you would have on a boat to hold it down'). Some single word semantic errors (target: bat, response: 'ball') may in fact actually be one word circumlocutions. That is, the person with aphasia might not necessarily be naming 'bat' as 'ball', rather giving a restricted description of some of its semantic characteristics. Consequently, Goodglass & Kaplan (1972) urge the need to distinguish between verbal paraphasic errors and one word semantic circumlocutions. Unfortunately they do not suggest how one might go about this or provide criteria for distinguishing responses.

2.4.3.7 Mixed errors

The term mixed error is used when an error is both semantically and phonologically related to the target (e.g. target: comma, produced: 'colon'; target: calendar, produced: 'catalogue' – examples from Harley, 1995). Clearly, on some

occasions, both semantic and phonological errors will appear to be also phonologically and semantically related respectively by chance. However, a number of authors (e.g. Dell & Reich, 1981; Harley, 1984) argued that mixed errors occur far more frequently than the chance level, although this has been questioned by Best (1996).

2.4.3.8 Perseverative errors

A perseverative error occurs when a recently produced phoneme cluster, word or phrase is inappropriately repeated when a different response is expected or anticipated (Hudson, 1968). This can occur as the recurrence of whole words, part words, or as a blend of a previous response and the current target (Papagno & Basso, 1996). For example, Gotts, della Rocchetta & Cipolotti (2002) describe the naming impairments of EB following a left CVA. EB produced a large number of perseverations in her spontaneous speech, in descriptive tasks, and in confrontation object naming. For example, when describing a beach scene, EB produced the following speech: "That's a small place boat (*describing boy falling off a boat*)... this is a small plot plause (*boy building sandcastle*)... that's a small plause (*father and son playing ball*)". EB appears to be somehow 'stuck' on a phrase, even though she demonstrated a high awareness of her speech by rejecting what she produced ("no, no it's not"). EB's perseverations generally, although not always, resulted in the production of recently produced real words. In a picture naming task, she correctly named pictures of a clock and a drum, but when asked to name a book, she said: "A drum... no a clock... no a drum". It appears that the presentation of a new stimulus has failed to provide sufficient activation to representations of the target word to override previously activated targets. In confrontation naming, a perseverative error may not be motivated by the most recently produced word. Cohen & Dehaene (1998) described a case where perseverative errors occurred after delays of up to 15 intervening items, although generally perseveration occurs on recently produced words. A number of EB's sampled perseverative errors (47%) were in some way semantically related to the target, whereas only 3% were phonologically related, therefore it does not appear to be a case of confusing words that

sound similar to each other. A further 44% of her errors had no obvious connection to the target. Similar cases of perseveration in aphasia have been described by Sandson & Albert (1984), Hirsh (1998), and Martin, Roach, Brecher, & Lowery (1998).

2.4.3.9 Unrelated errors

Some people with aphasia produce errors that are real words in the target language but have no semantic or phonological connection with the target word (e.g. target: giraffe, response: 'sledgehammer'; target: book, response: 'helicopter'). In their exploration of phonological deficits in aphasia, both Kay & Ellis (1987) and Kohn & Smith (1994) report cases of aphasia where a proportion of confrontation naming tests errors were unrelated real word errors, although in all three cases the proportion of unrelated errors was much smaller than phonological errors.

2.5 The relationship between word finding errors of people with and without brain injury

As early as 1891, Freud suggested that the types of errors made by aphasic people were not fundamentally different to those made by people without brain injury. The reason for the error might be different (i.e. permanent brain damage versus transient derailment), but the errors themselves are not fundamentally different.

Ellis & Young (1996) argue that some types of aphasic error represent a heightened tendency to errors which people without brain injury make as slips of the tongue. This develops Lenneberg's (1960) position that some types of aphasia are essentially abnormally augmented states of what is common in people without brain injury. Ellis & Young (1996) accept that there may be both quantitative and qualitative differences between non-brain-injured and aphasic errors, but suggest that these are outweighed by similarities. These observed similarities lend support to the assumption that impaired and unimpaired speakers employ the same speech production mechanism. Errors in aphasia arise from damage to that mechanism, whereas errors in normal production reflect its temporary derailment. The following section will outline two influential proposals about the nature of the speech production mechanism.

2.6 Cognitive neuropsychological models of lexical processing

The first model to be presented here (Figure 2.2) is redrawn from Nickels (2001), but it has appeared in a number of comparable versions over the last 20 years (e.g. Morton & Patterson, 1980; Levelt, 1989; Butterworth, 1989; Caramazza, 1997). Indeed, as research has progressed, neuropsychological data have contributed both to strengthening the model's validity and to its evolution.

The model makes four assumptions (outlined by Caramazza, 1986; Coltheart, 2001):

1. **Functional modularity**: At least some components of the cognitive system are modular. That is, they process independently (or relatively independently) of other cognitive modules.

2. **Anatomical modularity**: At least some of these modules are localised in different parts of the brain; therefore lesions in different parts of the brain can result in damage to different modules (or the interconnections between modules) and consequently lead to dissociating impairments.

3. **Universality of cognitive systems**: Even though people have different life experiences that may develop and strengthen differing skills, their basic cognitive processing systems are not fundamentally different.

4. **Subtractivity**: A brain injury results in damage to the extant cognitive system. It does not result in the development of new, abnormal processing systems.

Figure 2.2 identifies the processing modules believed to be involved in picture naming, from the initial visual analysis through to the articulation of speech. The *Visual Object Recognition System* (VORS) analyses the visual input before any semantic processing can take place. Damage to this visual object recognition system can result in visual agnosia (see reviews by Warrington, 1985; Humphreys & Riddoch, 2001), an impairment with very different symptoms to aphasia.

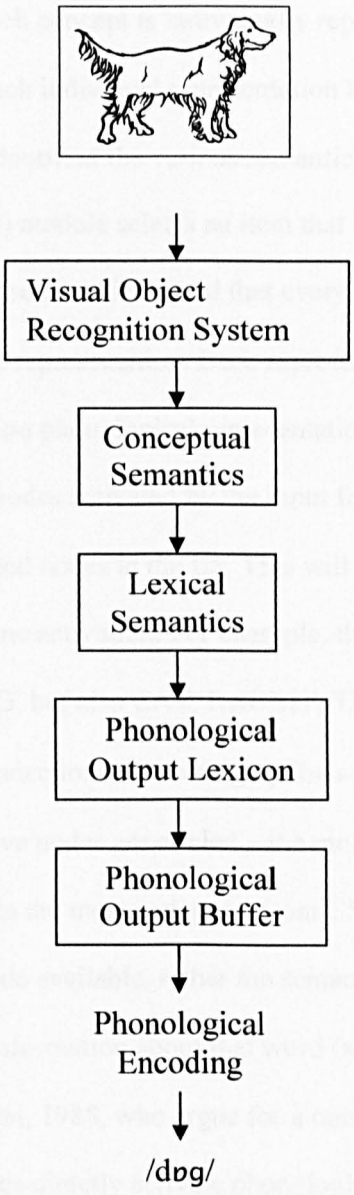


Figure 2.2: A serial model of levels of processing for naming a line drawing (after Nickels, 2001).

It is clearly possible to have a semantic representation for something where the word for it is unknown, or, indeed, something for which there is no name. Therefore, there must be a cognitive level that allows us to process these semantic representations on a conceptual rather than linguistic basis. This level is labelled "conceptual semantics" in the above model. Once the visual content of the picture has been analysed, the *Conceptual Semantics* (CS) module activates the semantic representations portrayed in the picture (e.g. target: dog, representations: animal, four legs, furry, tail, etc). Figure 2.3 (borrowed from Nickels, 2001) helps to illustrate this process. It contains the same

modules as Figure 2.2, but here each concept is individually represented. In fact, CS contains an entry, or 'node', for each individual representation known by that individual.

Once the CS system has identified the various semantic features conveyed in the picture, the *Lexical Semantics* (LS) module selects an item that best suits the activated semantic representations. In this module, it is argued that every word known by that individual is stored with a separate representation. Each representation contains only semantic features for each word – no phonological representation is accessed in this module. In Figure 2.3, all the CS nodes activated by the input from the VORS will in turn send activation through to connected nodes in the LS. This will result in many nodes in addition to the target receiving some activation. For example, the node 'furry' will not only activate the LS entry for DOG, but also CAT, RABBIT, TIGER, MOOSE, etc. Black lines represent activated connections, whereas grey lines represent connections not currently activated. Likewise; active nodes are circled – the more rings the more active the node. The LS item that receives the most activation from CS will be selected. At this stage, no phonological form is made available, rather the semantic features that equate to that entry and possibly syntactic information about that word (although see Morton, 1985, and Humphreys, Besner, & Quinlan, 1988, who argue for a one stage model of lexicalisation where semantic codes directly activate phonological forms). The semantic modules are not considered to be modality specific. That is, the same semantic module is accessed regardless of whether one is reading, understanding speech, speaking or writing.

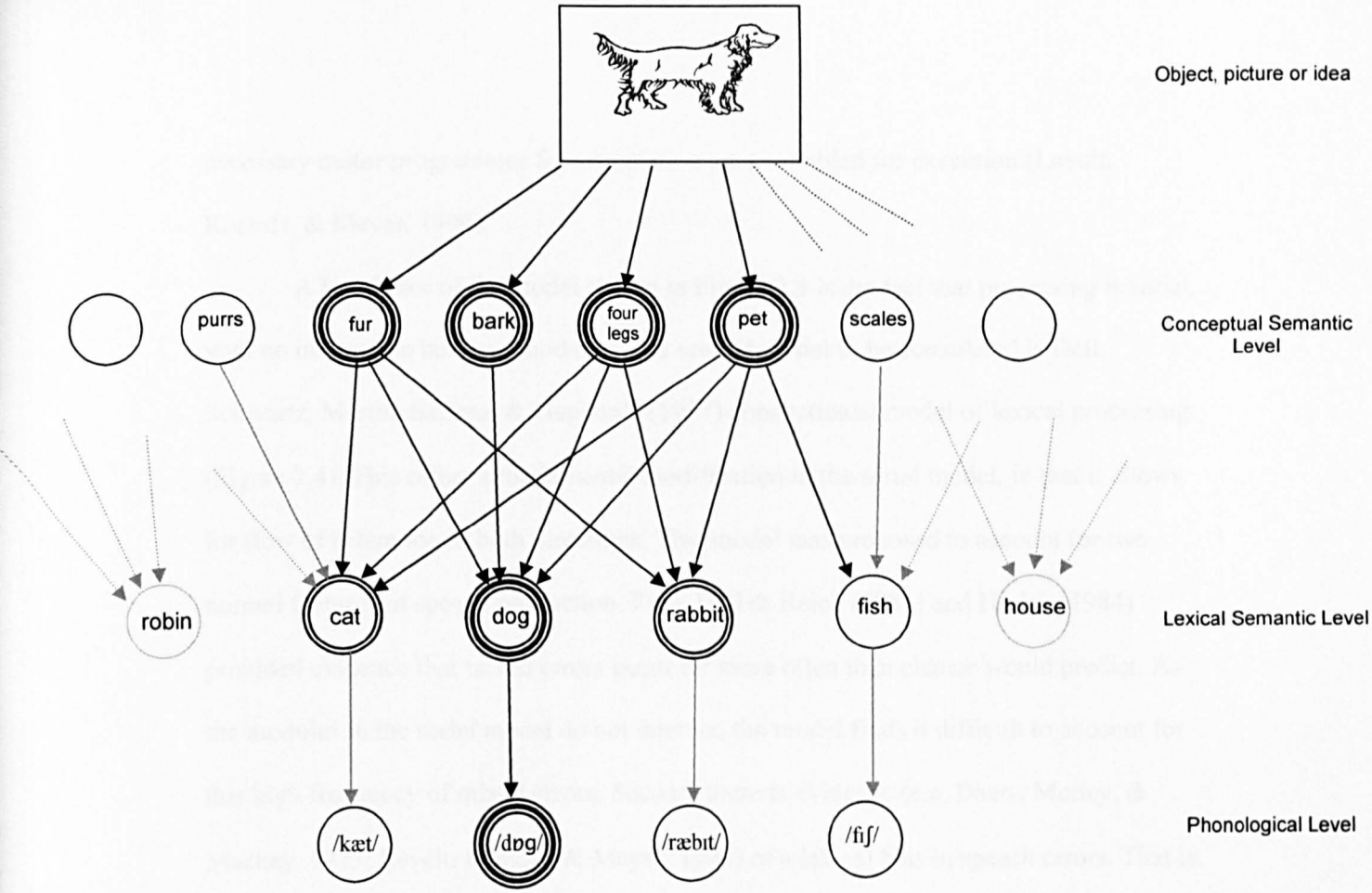


Figure 2.3: An example of how the word production process may result in multiactivation of semantic nodes (Nickels, 2001).

Once an item from the Lexical Semantics module has been selected, the *Phonological Output Lexicon* (POL) accesses and activates phonological and morphological properties of the target word. The POL is thought to contain a phonological representation for each word known by the individual. It is at this stage in the naming process that one applies the phonemes /d/, /ɒ/ and /g/ to the representation selected from the LS module. Output lexicons are considered to be modality specific. That is, if the POL contains the phonological information required to say the target word, another lexicon independent of the POL (i.e. an *Orthographic Output Lexicon*) would be accessed to ascertain which graphemes constitute the chosen word when the target is to be written.

The *Phonological Output Buffer* holds this phonological form in short-term memory until the word is produced. Finally, output from the POL is decoded and the

necessary motor programmes for articulation are assembled for execution (Levelt, Roelofs, & Meyer, 1999).

A key factor of the model shown in Figure 2.3 is the fact that processing is serial, with no interaction between modules. The second model to be considered is Dell, Schwartz, Martin, Saffran, & Gagnon's (1997) connectionist model of lexical processing (Figure 2.4). This offers a fundamental modification to the serial model, in that it allows for flow of activation in both directions. This model was proposed to account for two normal features of speech production. First, Dell & Reich (1981) and Harley (1984) provided evidence that mixed errors occur far more often than chance would predict. As the modules in the serial model do not interact, the model finds it difficult to account for this high frequency of mixed errors. Second, there is evidence (e.g. Baars, Motley, & Mackay, 1975; Levelt, Roelofs, & Meyer, 1999) of a lexical bias in speech errors. That is, errors that result in the production of real words in the target language occur more often than errors that produce non-words. Dell & Reich (1981) argued that lexical bias is caused by 'phoneme-to-word feedback' in the production process. That is, in contrast to the serial model, where each module produces a single output for processing by the next stage in the production process, activation not only flows in a 'top-down' but also a 'bottom-up' manner. This feedback effectively screens out both legal and illegal non-words.

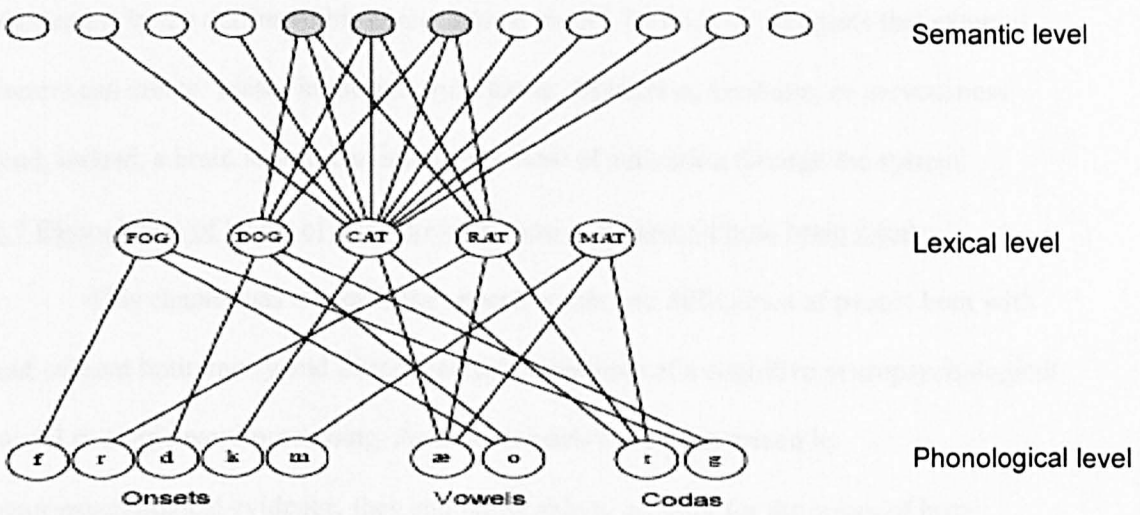


Figure 2.4: Interactive activation model of word production (target: cat, adapted from Dell, Schwartz, Martin, Saffran, & Gagnon, 1997).

Figure 2.4 illustrates the flow of activation involved in producing the word CAT. Here, target activation cascades from the semantic, to the lexical and then phonological levels. There is also non-target spreading activation across the network. For example, the semantic nodes that activate CAT at the lexical level will also partially activate DOG and RAT. These partially activated nodes will in turn send activation to the phonological level, resulting in non-target phonemes, such as /r/ and /d/, becoming active. In normal functioning, the greatest activation will converge on the target, allowing it to compete successfully with such spreading activation. Further support comes from feedback, in that the highly activated phonemes /k/ /ae/ /t/ reinforce the target lexical representation of CAT. However, if there is a temporary (or permanent) malfunctioning in the model, spreading activation will account for the production of errors, with the possibility of semantic, phonological and even unrelated substitutions. Here, feedback accounts for the mixed error effect. In the pictured network, RAT, as mixed error, is the most likely substitution for CAT since it receives both semantic input and feedback activation from the phonological level.

In non-brain-injured processing, this activation will often be weaker than phonemes connected to the target LS representation, as more activation will have been received from semantic nodes and, indeed, by back-reinforcement from the target phonemes. In the outline of his connectionist model, Dell (1986) suggests that external factors can create 'noise' in the system. That is, distraction, tiredness, or nervousness (and, indeed, a brain lesion) can impact the flow of activation through the system.

2.7 Dissociation of levels of breakdown in those with and without brain injury

This chapter has explored the speech errors and difficulties of people both with and without brain injury and introduced two variations of a cognitive neuropsychological model of single word processing. As these models have been driven by neuropsychological evidence, they should be able to account for the errors of both populations. Indeed, Nickels (1997:99) suggests that "a model of language processing

cannot be considered adequate unless it can account for patterns of impaired performance in addition to the normal speech errors and experimental data". As brain damage is often extensive, many aphasic people make a combination of errors where no clear pattern can be identified. Indeed, Ellis & Young (1996:117) note that "brain injuries are often extensive and are no respecters of cognitive theories, so most patients with naming problems are likely to exhibit mixed symptoms arising from impairment to two or more components". However, although cases where a 'pure' pattern of breakdown occurs are rarer, cases have been reported where only semantic or phonological errors predominantly occur. This evidence has contributed to the debate that semantic processing may occur independently of phonological processing.

2.7.1 Errors arising from CS module

As this module deals with conceptual rather than linguistic processing, people with a breakdown at this level would be expected to perform poorly on both linguistic (both expressive and receptive) and non-verbal tests of semantics. However, performance on non-verbal tests that do not require access to conceptual representations (such as the Raven's Progressive Matrices: Raven, Raven & Court, 1998) would remain unimpaired.

Nickels & Howard (1994) report the case of AER, who demonstrated an impairment at the conceptual semantic level. Although he was able to name over half the targets in a picture naming test, almost all his errors were semantic. His performance on the Pyramids and Palm Trees Test, a test of non-verbal semantic processing (Howard & Patterson, 1992), was poorer than age-matched controls without brain injury (e.g. he matched a picture of a bat to a picture of a woodpecker rather than an owl). He also chose semantic distracters in both spoken and written word-to-picture matching tests, and made more errors than controls on a synonym judgement task. As AER performed poorly in both linguistic and non-linguistic tasks requiring the accessing of semantic representations, Nickels & Howard argue that AER's breakdown was at the level of CS processing.

2.7.2 Breakdown at the LS level

Howard & Orchard-Lisle (1984) describe the case of JCU, a patient with severe aphasia. JCU's comprehension was limited and her spontaneous speech largely consisted of recurrent phrases. Object picture naming was predictably poor (5/30 on the picture naming section of the Western Aphasia Battery; Kertesz, 1982). She was responsive to phonological cues (i.e. providing the first phoneme, usually plus a schwa, of the target word), although she could also be 'tricked' into making a semantic error by providing a phonological cue of a semantically related item (e.g. target: tiger, cue: /l/, response 'lion'). She spontaneously rejected only 24% of these semantic errors, yet she rejected most (86%) of her unrelated errors. Additionally, when given a suggestion by the tester (i.e. 'Is this an X?'), JCU accepted 99% of correct suggestions and only 2% of unrelated suggestions, but also 56% that were semantically related to the target. Conversely, JCU performed well on the Pyramids and Palm Trees Test (Howard & Patterson, 1992); therefore her difficulties did not arise from a problem with recognising the picture or understanding its underlying conceptual representation. The authors argued JCU's difficulties arose as a result of a lexical-semantic deficit - being unable to access sufficient semantic information to be able to differentiate semantically related words. Further cases in the literature with a lexical semantic deficit include KE (Hillis, Rapp, Romani & Caramazza, 1990; Hillis & Caramazza, 1994), and TRC (Nickels & Howard 1994, 1995ab).

Further evidence of breakdown at the LS level can be found in aphasic people who demonstrate category-specific difficulties in noun naming. Over recent years a number of cases (Hart, Berndt & Caramazza, 1985; Farah & Wallace, 1992) have been reported where performance was significantly poorer on certain semantic categories than for others, even when other variables (such as word frequency and familiarity) are controlled for. For example, Farah & Wallace (1992) report the case study of the aphasic patient TU. In picture naming, TU performed significantly poorer on fruit and vegetables than in other categories, even when word frequency and familiarity were controlled for.

Most of TU's errors were semantic. This pattern of errors also occurred with naming actual objects and also when naming to a definition, although he was generally able to choose the correct item regardless of category in a word-to-picture matching task with two semantic distracters. The authors suggest that TU's deficit indicates that the LS module is organised categorically. TU's deficit could, they argue, be a selective impairment to semantically categorised addresses from LS to the POL, although this remains something of a contested issue (Parkin & Stewart, 1993; Job, Miozzo & Sartori, 1993).

2.7.3 Breakdown in the POL

Kay & Ellis (1987) report the case of EST, an aphasic person whose performance strongly contrasts with JCU. Whereas JCU's assessment profile indicated a semantic impairment, EST performed at the level of unimpaired controls on the Pyramids and Palm Trees Test (Howard & Patterson, 1992) and experienced no difficulties either on word-to-picture matching tests or when sorting pictures into semantic categories. EST's spontaneous speech was fluent but characterized by word finding difficulties which he tried to mask by producing semantically related circumlocutions. The true extent of his anomia was revealed in confrontation naming of the Snodgrass & Vanderwart (1980) picture set. He was able to name a third of the pictures correctly, but also made predominantly phonological errors (e.g. target: lobster, response: '/lɒg/ /lʌb/ /lɒŋ/ is it L, O? /lɒ/ /lɒg/ couldn't be a log ... g ... /lɒŋ/'; target: grapes, response: 'eat it and 5 (letters) /græfs/ /grɪf/ /græf/ /grɪf/ /grɪt/ /grɪtʃ/ not /græs/') and some semantic errors (e.g. target: axe, response: '3 begins with s, not a saw... it's a hammer, it's not a hammer...same sort of... I jumped at the wrong thing... say a lump of wood and you wanted to chop it in two... a chopper... has it got 3 letters in it? A saw, not a saw.'). On many occasions when he experienced a word finding error, EST was often able to demonstrate understanding of the concept and at least partial access to phonological and orthographic details. Kay & Ellis report that EST showed a strong frequency effect in the naming task. That is, he was far more likely to experience difficulty on low frequency

words. In this case, breakdown can be localised to the POL. The appropriate LS representation has been selected, but only part of the word's lexeme has been accessed. An assumption here is that high frequency words require less activation to 'fire' than low frequency words. That is, the more often a word is produced, the higher the residual or 'resting' levels of activation (see Stemberger, 1985). If EST had a general reduced level of activation available to language processing, those items with a higher resting level of activation would be easier to produce than those needing a greater activation surge. EST still has the representation of the target lexeme in the POL; the difficulty is one of access.

TOT states and some word finding delays in unimpaired speakers can be accounted for in much the same manner. LS representation selection may have occurred, but lexeme selection remains incomplete – hence the speaker often being able to say what the first sound is or how many syllables the word has. However, the serial model finds it difficult to account for TOT states and EST's word finding difficulties where the speaker can demonstrate partial access to the phonological representation of the word. As each module processes independently, the target word either receives sufficient activation to fire and send an output or it does not – the model does not predict partial outputs. Conversely, as activation cascades through the connectionist model, noise in the system could potentially restrict access to some of the phonological nodes connected to the LS representation, while other phonemes remain available.

EST's word finding difficulties were inconsistent. That is, he did not always experience retrieval difficulties on the same items – the POL representations were intact, but EST's access to these representations fluctuated depending on the amount of activation available for language processing (see also Graham, Patterson, & Hodges, 1995; Lambon Ralph, Sage, & Roberts, 2000). Other cases (e.g. Howard, 1995) have been reported who experienced similar difficulties to EST (good semantic knowledge but phonological errors during word naming tests), but who in contrast to EST consistently experienced word finding difficulties on the same target items. This consistency in word

finding difficulties indicates that the POL representations themselves have been damaged, rather than the difficulty being one of compromised access.

2.7.4 Errors where locus of breakdown is potentially multifactorial

A number of errors introduced in this chapter are less easy to localise to a breakdown in a particular processing module. For example, the production of neologisms has been accounted for as breakdown in both LS and POL modules. Nickels (1997) suggests that a neologism could have been initially an LS selection error that was then further compounded by phonological errors, thereby rendering the initial target potentially unrecognisable. This is plausible, as compound semantic-phonological errors have also been reported where the phonological error has not disguised the semantic error, e.g. target: horse, response: /dɒŋkɪŋ/ (Robson *et al.*, 2003). Conversely, Buckingham (1987) suggests that neologisms could be phonological errors where so many phoneme substitution errors have been made that the target has become unrecognisable. Indeed, there is also some evidence that apparently unrelated neologisms are in fact more related to the target than would be predicted by chance (Robson *et al.*, 2003). Butterworth (1985) proposes that there may be a random phoneme generator that 'kicks in' in the total failure of lexical retrieval to fill a gap with a phonotactically legal string of phonemes where syntactic structure demands there be a word present. The production of unrelated real words might also be similarly accounted for as a 'gap filler' – if no lexical item has received sufficient activation for selection, a lexeme might be randomly selected from the POL.

2.8 Treatment of unilingual anomia

Although a number of different types of treatment for aphasia have been reported (such as early surgical, c.f. Howard & Hatfield, 1987, and more recent pharmacological interventions, Enderby, Broeckx, Hospers, Schildermans, & Deberdt, 1994; Walker-Batson, Curtis, Natarajan, Ford, Dronkers, Salmeron, Lai & Unwin, 2001; Berthier, 2005) SLT accounts for the majority of aphasia treatment and is consequently the focus of

this section. Studies exploring the effects of various types of treatment on various types of aphasia have been steadily growing over the last two decades, although our understanding of therapy outcomes remains underdeveloped. Nickels (2002) acknowledges that it is not yet possible to pair reliably a therapy task with a particular language impairment and predict an outcome. However, she also suggests that there have been sufficient recent studies that justify making tentative generalisations about therapy outcomes. Indeed, studies exploring anomia are the most numerous and consequently offer the most robust evidence of outcomes in comparison to other impairments. This preponderance of anomia treatment studies could reflect clinical practice, i.e. it is commonly employed as a target in clinical SLT since word finding difficulties are such a common characteristic of aphasia. It could also be because it is easier to control potentially confounding variables when working with single words. Likewise, it could also reflect the influence of the cognitive neuropsychological models in the field of aphasia therapy (Whitworth *et al.*, 2005). Clearly, naming therapy is not carried out simply to improve performance in confrontation naming tasks, but with the expectation of carryover into everyday conversation (Lesser & Milroy, 1993). However, such a carryover into conversation is by no means a given, and studies exploring this are somewhat limited in number (but see Lesser & Algar, 1995; Hickin *et al.*, 2001).

2.8.1 Short-term facilitation treatments

A number of studies have explored whether people with aphasia can be facilitated or cued to produce a word which they are (at that moment, at least) unable to produce. Studies have typically carried out a confrontation naming task where participants were offered a cue on targets which elicited either an error or no response. Table 2.3 outlines the different types of cues that have been explored as facilitators of naming with aphasic people.

Type of cue		Example (target: hammer)
Semantic	Description	"You use it bang a nail into wood"
	Category	"It's a type of tool"
	Related	"Nail"
Phonological	Word-initial phoneme	"It's a /hə/"
	Onset to first vowel	"It's a /hæ/"
	Rhyme	"It rhymes with stammer"
Graphemic	Word-initial grapheme	"It begins with H"
	Spelled aloud	"It's a H A M M E R"

Table 2.3: Examples of various cueing strategies.

As an immediate facilitator of word retrieval, phonological cues have shown by far the most powerful effect. Indeed, the literature exploring immediate prompting is largely consistent in its findings: Phonological cues are by far the most powerful prompt, whereas semantic cues are generally not very useful in the immediate short-term (Rochford & Williams, 1962; Myers-Pease & Goodglass, 1978; Howard *et al.*, 1985a; Best, Herbert, Hickin, Osborne, & Howard, 2002). Despite the powerful effect of phonological cueing on immediate word retrieval, early evidence (e.g. Patterson, Purell, & Morton, 1983; Howard *et al.*, 1985a) indicated this effect is not long-lasting (although see Section 2.8.3 below). Conversely, semantic primes (such as word-to-picture matching and semantic judgement tasks) were longer lasting, with facilitatory effects lasting up to 24 hours following the prime (Howard *et al.*, 1985a). Howard *et al.* attribute this difference to the necessity of accessing (and therefore activating) semantic representations of targets during semantic tasks but not (necessarily) in phonological tasks. It may be the recent activation of the semantic representations that causes the longer lasting priming effect.

As it is often difficult to predict the outcomes of SLT targeting word finding difficulties (Nickels & Best, 1996), potentially important evidence is emerging that demonstrates a link between (unilingual) aphasic clients' responses to cueing during assessment and outcomes following a block of word finding therapy. Best and colleagues (Best, Hickin, Herbert, Howard, & Osborne, 2000; Hickin, Best, Greenwood, Grassly, &

Howard, in preparation) found evidence of a significant correlation between how well clients retrieved words they were unable to name during assessment when offered phonological or graphemic cues, and how well they responded to therapy targeting word finding difficulties. That is, clients who responded poorly to cueing during assessment also failed to improve following a block of word finding therapy. Likewise, those who responded well to cueing during assessment (despite performing similarly in uncued naming tests to those clients who failed to respond to cues) also demonstrated significant gains after treatment. Chapter 4 of this study will highlight the lack of evidence available to guide the clinician when treating bilingual speakers with aphasia; therefore exploring a possible link between bilingual participants' responses to cues during assessment and outcomes of word finding therapy will be explored as part of the current study (in Chapter 8).

2.8.2 SLT targeting longer-term gains

Although the types of cues described above have also been used in studies targeting longer lasting improvement in the word retrieval abilities of people with aphasia (e.g. Best, Herbert, Hickin, Osborne, & Howard, 2002; Fink, Brecher, Schwartz, & Robey, 2002), a wide range of tasks and activities have been explored beyond simple cueing techniques. In her review of studies exploring the treatment of word finding difficulties in unilingual aphasia, Nickels (2002) outlines two broad approaches that have been implemented. First are what she terms strategic, reorganizational or compensatory approaches. Here, the emphasis is on training clients or participants to draw on (largely) intact skills to compensate or support the skills that have been impaired by brain injury. For studies of word retrieval, this has often taken the form of training participants to use their spared knowledge of the written form of words to facilitate their impaired retrieval of spoken words. Positive outcomes following this type of treatment have been reported (e.g. Bachy-Languedock & de Partz, 1989; Bastiaanse, Bosje, & Franssen, 1996; White-Thomson, 1999), although Nickels (2002) notes that this approach will only be potentially

beneficial for those where the written modality remains less impaired than spoken word retrieval.

Nickels' (2002) second approach targets the facilitation, repair or re-teaching of the impaired skills themselves. Indeed, most SLT activities targeting the improvement of word retrieval fall into this category. Here, the focus is on offering clients language stimulation tasks which will, if successful, result in reactivating or re-teaching word retrieval skills without using compensatory strategies. There is a growing body of research that provides evidence of significant gains in word retrieval abilities following treatment using a range of therapy tasks. This therapy has traditionally been delivered by a SLT working directly with clients, but there has been a recent growth in the number of studies where word finding therapy has been delivered effectively using information technology (e.g. Deloche, Dordain, & Kremin, 1993; Deloche, Hannequin, Dordain, Metz-Lutz, Kremin, Tessier, Vendrell, Cardebat, Perrier, Quint, & Pichard, 1997; Pedersen, Vinter, & Olsen, 2001). Here, the SLT's role has often been one of assessing, training clients to use the programs, and evaluating outcomes rather than delivering therapy tasks directly to the clients.

Even though the use of computers when delivering word finding therapy may be growing, the most common mode of delivery remains the traditional model where the SLT works on a largely 1:1 basis directly with the client. These therapy activities have broadly been dichotomized as targeting either semantic or phonological processing (although this dichotomy has been questioned – see Section 2.8.3 below). Semantic tasks typically require the client to consider aspects of the target word's meaning. There is considerable evidence of successful therapy outcomes using semantic tasks such as word-to-picture matching (where the client has to match a word, often written, to the correct picture from a group, where the alternatives are typically related in meaning; e.g. Marshall, Pound, White-Thomson, & Pring, 1990; Nickels & Best, 1996), naming to definition (where the client trying to name the word is presented with a spoken description of a target drawing on semantic features, e.g. target rabbit: "This a type of

animal, it's got floppy ears, a bushy tail, and likes to eat carrots", e.g. Drew & Thompson, 1999; Greenwald, Raymer, Richardson, & Rothi, 1995), or sorting pictures by category (such as fruits vs. vegetables, e.g. Drew & Thompson, 1999; Kiran & Thompson, 2001).

Phonological tasks generally invite the client to consider the sound structure of words. Such tasks include word repetition (e.g. Hickin *et al.*, 2002), syllable counting (Rose, Douglas, & Matyas, 2002), rhyme judgment (i.e. "Does the word for this picture rhyme with bat?" Raymer *et al.*, 1993;), or initial phoneme identification or judgement (i.e. "This word is potato. What is the first sound of potato?" Hickin *et al.*, 2002; Raymer & Ellsworth, 2002).

The tasks used for the current study were drawn from a range of studies where significant improvements in word retrieval were elicited from treatment. These tasks are outlined and described in Section 8.2.3.

As noted above, when compared to other aphasic impairments, studies indicating positive outcomes from SLT targeting word retrieval difficulties are by far the most abundant. Although quite a large number of studies have used an experimental design, experimental methodologies have not always been implemented, and case reports have often been somewhat anecdotal. Some studies have carried out pre-SLT assessments soon after the participant's CVA or failed to control for spontaneous recovery (e.g. Cubelli, Foresti, & Consolini, 1988; Sugishita, Seki, Kabe, & Yunoki, 1993; Grayson, Hilton, & Franklin, 1997). Indeed, details of the therapy tasks themselves have not always been clearly outlined (e.g. Aftonomous, Steele, & Wertz, 1997) or small numbers of test items make gains difficult to interpret (e.g. Le Dorze & Pitts, 1995; Lowell, Beeson, & Holland, 1995; McNeil, Doyle, Spencer, Goda, Flores, & Small, 1997). Likewise, statistics have not always been used to establish significance of therapy gains (e.g. Raymer, Thompson, Jacobs, & Le Grand, 1993; Hillis, 1998; Murray & Karcher, 2000).

2.8.3 Phonological versus semantic therapy

Following Howard *et al.*'s (1985ab) influential pair of papers, evidence has been accumulated that broadly supports their claims: Both phonological and semantic tasks

delivered in a block of SLT (typically lasting between 6 and 10 sessions) can result in positive outcomes in the word retrieval abilities of people with aphasia. On treated items, semantic tasks typically had long lasting effects following SLT (e.g. Marshall, Pound, White-Thomson, & Pring, 1990; Pring, White-Thomson, Pound, Marshall, & Davis, 1990; Nettleton & Lesser, 1991). Although Howard *et al.*'s (1985b) study indicated that gains from phonological therapy might be less robust than semantic therapy, later studies subsequently provided evidence of long lasting gains from phonological therapy (e.g. Wingfield, Goodglass & Smith, 1990; Davis & Pring, 1991; Stimley & Knoll, 1991; Raymer *et al.*, 1993; Miceli *et al.*, 1996; Hickin, Best, Herbert, Howard, & Osborne, 2002).

There has been some debate in the literature about when to employ semantic and/or phonological tasks in therapy. Some researchers have used both techniques simultaneously with all participants (e.g. Howard *et al.*, 1985ab). Others have argued for a more prescriptive approach, whereby the nature of the deficit drives the selection of tasks (e.g. Nettleton & Lesser, 1991; Miceli *et al.*, 1996). However, this issue remains unresolved, and several researchers (e.g. Behrmann & Byng, 1992; Caramazza & Hillis, 1993; Howard, 2000) have called this apparent distinction between semantic and phonological tasks in to question. Howard (2000) argues that both types of task might actually provide a more general language stimulation that activates both semantic and phonological modules. That is, in semantic tasks, the spoken form of the word is usually produced at some point in the task (therefore offering what would be considered to be phonological activation). Conversely, in phonological tasks, a picture of the target is often used (thereby activating semantic processing). Likewise, upon production of the target word, the client is likely to access its meaning. Howard (2000) suggests that both tasks might effectively work in the same manner – both strengthen mappings between semantic and phonological representations of the target through simultaneous activation of each level of representation. If the effects from semantic and phonological therapy can be

shown to be different, particularly with respect to generalisation, this would support the argument that these therapies are doing different things.

2.8.4 Generalisation of SLT gains

Early studies (e.g. Schuell, Jenkins, & Jimenez-Pabon, 1964) of treating word finding difficulties in aphasia often made the assumption that improvements on words practised in therapy would naturally generalise to all untreated words as well, and, indeed, all language contexts. However, more recent research (e.g. Howard *et al.*, 1985b; Marshall *et al.*, 1990; Herbert, Best, Hickin, Howard, & Osborne, 2003) has clearly demonstrated that not only is this not always the case, but also that the therapy effect is generally item-specific. Generalisation to untreated items is more likely to occur when SLT has sought to provide a strategy (such as self-cueing) that a client can apply to all words than when reactivation treatments have been utilised (Bruce & Howard, 1987; Nickels, 1992). Of course, the possibility of implementing such compensation strategies depends on each client's extant skills (otherwise SLT would much easier!).

Some studies have resulted in generalised gains to untreated words (e.g. Best, Howard, Bruce, & Gatehouse, 1997; Robson, Pring, Marshall, Morrison, & Chiat, 1998; Pedersen, Vinter, & Olsen, 2001; Fink *et al.*, 2002), but our present understanding of word retrieval impairments and therapy is insufficient to predict which types of therapy will result in generalised improvements (Nickels, 2002). However, as explained above, there is a high chance of SLT resulting in item-specific naming improvements; therefore it is clearly advantageous if therapy items will be functionally useful to the client in the potential absence of generalisation to untreated words.

2.9 Summary

Although the current study concerns bilingual aphasia, it was vital to review the progress of research exploring unilingual word finding difficulties and treatment. Considering there may be more bilingual speakers in the world, research has been very much dominated by studies of (apparently) unilingual language users. Consequently, unilingual research has strongly influenced progress in bilingual research and the

assessment and treatment of bilingual aphasia. This chapter has explored a number of areas, including the history of confrontation naming studies of both in aphasia and in people without brain injury, current models of unilingual word processing driven by cognitive neuropsychology, and treatment strategies and outcomes for aphasic word finding difficulties. Nickels (1997:199) accepts this is "an area of immense complexity", and the current review can only highlight key areas of research that are relevant to the current study.

3 Bilingualism: Issues and ideas

3.1 What is bilingualism?

At first glance, the answer to the question above appears to be obvious – somebody who speaks two (or more) languages can be considered to be bilingual. Unfortunately, this "obvious" answer becomes more problematic when given a little more consideration. For example, how proficient does a person have to be in both languages to be bilingual? Does a bilingual person have to have learned both languages as a child? Would somebody who could speak only one language but understand another well enough be excluded? Indeed, what counts as two languages? i.e. is somebody who speaks what are labelled as 'dialect' and 'standard' forms of the same 'language' a bilingual?

Clearly, a classification of being bilingual depends on the definition of bilingualism that one adopts. Early definitions tended towards the absolute: Bloomfield (1933: 55) excluded those who did not possess a "native-like" proficiency in two languages. Not only is it unclear quite what "native-like" means and how to establish it, one is also faced with the difficulty of classifying those who do not meet these demanding standards of proficiency but who have nevertheless acquired skills in more than one language. These 'in-betweeners' could not be termed unilinguals, so what are they if not bilingual?

A great deal of attention has been given to bilingualism since Bloomfield's work, and inevitably the range of definitions of bilingualism has been extended far beyond his somewhat restricted criterion. Grosjean's (1989) well-known argument that a bilingual is not the sum of two unilinguals is often quoted for good reason. It is clear that the languages spoken by an individual must interact with each other in a complex manner. Even the language skills of the most evidently proficient bilingual will not be absolutely balanced – patterns of language use will inevitably mean that that person will be more proficient in one language than another, depending on which language is generally used in various environments and situations. Indeed, Sebastián-Gallés, Echeverria, & Bosch (2005) demonstrated that even in bilinguals who learned both their languages from birth,

there will always, without fail, be a dominant language no matter how fluent or proficient that person may be in the L2.

A wide range of definitions of bilingualism are currently available. Indeed, one might consider the range of definitions to be a continuum, at one extreme are "maximal" bilinguals (those who come close to Bloomfield's definition of being highly proficient in two languages), while at the opposing end are "minimal" bilinguals (those who know only a few words in a L2). Indeed, a high number of other definitions of bilingualism can be placed between these two extremes. In his review of the field of bilingualism, Wei (2000) outlines no less than 37 definitions of bilingualism, all of which are valid but not mutually exclusive descriptions. To demonstrate the range of these definitions, a selection is presented in Table 3.1

Minimal bilingual	Someone with only a few words and phrases in an L2
Semilingual	Someone with insufficient knowledge of either language
Ascendant bilingual	Someone whose ability to function in an L2 is developing due to increased use
Balanced bilingual	Someone whose mastery of two languages is roughly equivalent
Dominant bilingual	Someone with greater proficiency in one language than the other
Late bilingual	Someone who has become bilingual later than childhood
Early bilingual	Someone who has acquired two languages early in childhood
Natural bilingual	Someone who has not undergone any specific training to become bilingual
Receptive bilingual	Someone who understands an L2 either in its spoken or written form, or both, but does not necessarily speak or write it
Compound bilingual	Someone whose languages are learned at the same time in the same context
Coordinate bilingual	Someone whose languages are learned in distinctly separate contexts
Maximal bilingual	Someone with near native control of two or more languages

Table 3.1: Some definitions of bilingualism reflecting a range of proficiency (after Wei, 2000).

3.2 The impact of language acquisition history on second language (L2) ability

Lenneberg's critical period hypothesis (1967) has had a massive influence on mainstream beliefs on L2 learning. In brief, Lenneberg argued that there is an innate ability to acquire language effortlessly (regardless of it being L1 or L2). This ability rapidly declines at puberty as the brain loses its plasticity and the lateralisation of language in the left hemisphere is completed. As the critical period ends, language

acquisition becomes more effortful and generally less successful than languages acquired before puberty.

Although Lenneberg's theory has been powerfully influential in the mainstream, it is far more controversial within the field of bilingual research. Several researchers (e.g. Harley, 1989; Newport, 1990) have questioned the biological basis of Lenneberg's position and suggest that any difference in L2 learning abilities for children and adults may reflect psychological and social factors rather than a biological disposition to language learning. Indeed, some studies have failed to find any evidence at all that children outperform adults who have had similar amounts of input in tests of L2 skills (Snow & Hoefnagel-Hoehle, 1978; Mägiste, 1992), although Krashen, Long, & Scarcella (1979) argue that adults are slower to learn L2 complex structures than children. Phonology is the one area of language where Lenneberg's (1967) theory of the advantages of children has received extensive confirmation (Romaine, 1997) – children are less likely to have a foreign accent in their L2 than people who learn a L2 after puberty (Fathman, 1975).

Another distinction that is relevant to early versus late bilinguals is that of language acquisition and language learning (Krashen, 1985). Language acquisition is a subconscious process; conscious focus and revision is unnecessary here, as is any metalinguistic knowledge. Clearly, children *acquire* language without the need for language or grammar lessons – a four-year-old is unlikely to have much to contribute to discussion of *wh-* movement but is normally entirely able to ask where her ball is. In contrast to language acquisition, language learning is a product of formal instruction and results in metalinguistic knowledge about a language that can be implemented in language production (i.e. one learns the rule about formatting wh- questions and draws on this knowledge consciously when asking a question).

Krashen's acquisition/learning dichotomy is largely synonymous with the distinction some researchers (e.g. Reber, 1993; Ullman, 1999; Lebrun, 2002) have made between implicit learning versus explicit knowledge. Implicit learning is unconscious and

effortlessly acquired through practice. It not only applies to child language acquisition but also to a range of abilities including motor, perceptual and cognitive skills. Conversely, explicit knowledge is conscious, and is often associated with the storage of facts, rules and instructions.

Clearly, it would be over-simplistic to suggest that language learned as a child implements implicit learning, and language learned after puberty solely explicit knowledge. It is far more likely that adult L2 acquisition involves an interaction between implicit and explicit knowledge. This distinction could be essential for studies exploring bilingual aphasia. As Cohen & Eichenbaum (1993) have demonstrated, explicit knowledge is stored bilaterally in extensive areas of the cerebral cortex. Paradis (1994) argues that explicit knowledge about an L2 will be more widely represented than the predominantly implicit L1 knowledge. Consequently, the neural substrate for L2 would be more widely represented than that for L1, which relies on implicit acquisition (Ullman, 1999). This predicts that L2 might be more resistant to brain injury than L1. Unfortunately, however, most studies of bilingual aphasia have found that this is not the case (see Section 4.5).

3.3 Attitudes towards bilingualism

In the West at least, mainstream attitudes towards bilingualism have changed radically over the last fifty years. Wei (2000) notes that before the 1970s, there was an underlying belief that bringing children up as bilingual resulted in potentially severe disadvantages, such as a lower IQ than unilingual peers, mental confusion, schizophrenia, left-handedness, low self-esteem, and speech and language difficulties. Indeed, research presented evidence to strengthen these positions (e.g. Laurie, 1890; Saer, 1923; Skutnabb-Kangas, 1981), although these studies may be biased (see Section 4.3.2). Indeed, Wei (2000) notes that even if a group of bilingual children did demonstrate one of these purported disadvantages, it is difficult to demonstrate that bilingualism causes the difficulty.

Negative attitudes towards bilingualism are certainly not a recent development. Fabbro (1999) notes that Parmenides (5th century BC) was looked on with suspicion by Greeks as he was bilingual, being born in Italy to Greek parents. Miller (1984) suggests that these negative attitudes towards bilingualism may have been compounded by increased migration to the West in the twentieth century. Migrants generally (if not always) leave their home countries in search of a better life, escaping poverty, war, natural disasters, or persecution, and are consequently assigned low prestige in their host countries. Indeed, it appears that migrant communities were generally tolerated in the West with the tacit understanding that migrants would assimilate to the host culture and essentially leave their past (and by implication, their language) behind them, with second generations being brought up unilingually in the language of the host culture. When this failed to occur, the resulting bilingualism was treated with suspicion and seen potentially as a threat.

Attitudes to bilingualism are changing. Some suspicion may remain in mainstream society, and one can still encounter the received wisdom that educating a child bilingually can have detrimental effects (e.g. Guzman, 2002). However, research now presents overwhelming evidence of the advantages of being bilingual. In contrast to the mental deficiencies purported to result from bilingualism, there are no IQ differences between uni- and bilingual children (Lambert, 1992; Lambert, Genesee, Holobow, & Chartrand, 1993). Indeed, being bilingual can in fact result in faster cognitive development than unilingual peers, especially in young children (Wei, 2000). For Grosjean (1982), himself a French-English bilingual, bilingualism is neither a problem nor an asset, merely a fact of life.

3.4 Language versus dialect

What counts as being bilingual? Does one have to speak two 'proper' languages to be bilingual or can one include dialects? Clearly, this is a loaded question, but there is a widespread misunderstanding of what is actually a language. What has become the standard variation of a language is often considered to be its 'correct' form, where other

regional variations are mere deviations (Hudson, 1996). For Chomsky (1977), the distinction between a 'language' and a 'dialect' is entirely arbitrary. The standard form of a language has become so due to entirely non-linguistic reasons. It is simply the most prestigious dialect which has prevailed politically as a result of state and educational use, as well as often being the dialect used by mass media and having a literary heritage. It is no more 'correct' than any other variations. Indeed, Chomsky (1977) argues that a linguist unfamiliar with borders or political institutions would be unable to distinguish between a 'language' (i.e standard form) and a 'dialect' (i.e. regional variation). For Hudson (1996), a 'language' must include the sum of all grammatical and lexical variations in all related dialects, even though native speakers of the dialects themselves may not be mutually intelligible.

The challenge of dealing with regional variations is a theme that recurs throughout this study. The regional variations of Bengali are discussed in Section 5.5 and the implications of these on the current project are raised in Section 5.9. Section 6.7 reports how regional variations of Bengali impacted on identifying targets to include in the word finding assessments that were developed as part of this project.

3.5 Neuro-anatomical lateralisation of language processing

Over the last three decades, a great deal of attention has been given to exploring if the representation of language in bilinguals is less left hemisphere-dominant than in unilingual speakers. Increased right hemisphere use in bilinguals has been reported for L2 in late bilinguals (Albert & Obler, 1978; Weber-Fox & Neville, 1996; Kim, Relkin, Lee, & Hirsch, 1997) and for very specific subgroups (e.g. early or late bilingual women but only late bilingual men, Vaid & Lambert, 1979) or very specific (sometimes bizarre) conditions (e.g. only when eyes are closed: Moss, Davidson, & Saron, 1985; when one nostril is blocked: Shannahoff-Khalsa, 1984). However, subsequent research has not been able categorically to prove lateralisation differences for any of the above subgroups or conditions. Paradis (1990; 1992), who is dismissive of the relevance of exploring lateralisation differences in bilinguals, notes that for all the studies presenting evidence

for a range of lateralisation differences (which Paradis actually questions on methodological grounds), there are at least an equal number of studies that demonstrate no difference at all between the lateralisation of uni- and bilingual language. Indeed, if L2 was more reliant on the right hemisphere, L2 should be more vulnerable to a language deficit following right hemisphere damage. However, neuropsychological data do not support this position, and although communication disorders following right hemisphere damage in left hemisphere dominant bilinguals has been reported, it does not occur to a greater extent than in unilinguals (Alexander, Benson, & Stuss, 1989; Joanette, Goulet, & Hannequin, 1990).

Conversely, Mechelli, Crinion, Noppeney, O'Doherty, Ashburner, Frackowiak, & Price (2004) present evidence of increased left hemisphere density of grey matter in a group of Italian-English bilinguals. The researchers discovered that grey matter density of the left hemisphere inferior parietal cortex of their group of bilinguals was significantly greater than in their unilingual group. They also found that overall proficiency correlated negatively with age at acquisition; therefore they also argued that the grey matter density in this brain region increases with L2 proficiency but decreases for those with a later AoA.

3.6 The bilingual lexicon

Regardless of how many languages a person speaks, it is largely agreed that the language processing system must include a store (or possibly stores) of known lexical items. This section will refer to this store as the lexicon, but some researchers have used different terminology to refer to it. To clarify, what is referred to here as the output lexicon is synonymous with the POL of the serial model of Figure 2.2 and the lexical level of the interactive activation model presented in Figure 2.4. Much attention has been given to the question of how the lexicon(s) of languages spoken by a bilingual might be organised. That is, are lexical items from the L1 stored independently from the L2, or is the lexicon of a bilingual essentially an extended single lexicon that contains all lexicon items from both (or indeed, all) languages (Gollan & Kroll, 2001)?

Bilingual performance on lexical decision tasks has provided evidence to support the dual lexicon hypothesis at the input level. Initially carried out with unilinguals to explore lexical memory, lexical decision tasks require participants to judge whether a presented word is real (in their language) or not. If a stimulus recurs later in the same experiment, judgement latency is faster than the original judgement, i.e. the initial activation of that item primes the second presentation of the word (Scarborough, Cortese, & Scarborough, 1977). Similar tasks have been carried out with bilinguals to explore cross-linguistic priming. If lexical items from both languages are stored in a common representation, a stimulus should prime not only a repetition of the word in the same language, but also the lexical equivalent in the other language spoken. A number of studies have failed to find evidence for this (Brown, Sharma, & Kirsner, 1984; Kirsner, Smith, Lockhart, King, & Jain, 1984; Gerard & Scarborough, 1989), which has been taken as evidence for independent lexicons for each language.

However, there is evidence of cross-linguistic semantic priming in bilinguals. That is, if a target (e.g. 'dog') is primed with a semantically related word (e.g. 'cat'), there is a significant increase in speed of response even when the prime is presented in the non-target language (e.g 'Katze' for English-German bilinguals). Although cross-linguistic semantic priming has a very short-term effect and is typically stronger when the prime is in the L1, there is robust evidence demonstrating this effect (e.g. Schwanenflugel & Rey, 1986; Chen & Ng, 1989; Francis, 1999). This evidence has been interpreted as evidence for a single shared semantic system in bilinguals rather than as evidence for a single lexicon.

A number of models of bilingual language processing have been suggested to illustrate the distinction between shared semantic processing and independent lexicons (Green, 1986; de Bot, 1992; de Groot, 1992; Smith, 1997; but see Kirsner, Lalor, & Hird, 1993, for an opposing view). These models have been strongly influenced by cognitive neuropsychological models of unilingual language processing (see Section 2.6). Figure 3.1 presents Green's (1986) suggestion for a model of bilingual language processing. This

follows the serial unilingual models that were influential at the time (such as Morton & Patterson, 1980). Semantic processing (the 'conceptual and intentional system') is central, whereas lexicons are independently represented. A 'specifier' is placed between semantic and lexical processing to determine the target language following the output of the semantic module. This, in combination with language-specific inhibitory controls, results in the inhibition of the non-target language (see also Green, 1993).

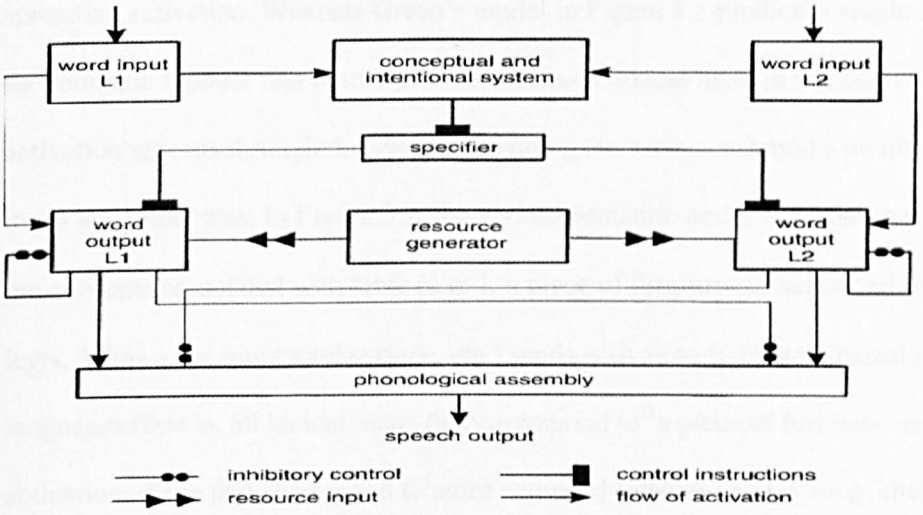


Figure 3.1: Green's (1986) serial model of bilingual word processing .

Green incorporated a 'resource generator' to account for the symptoms of alternating antagonistic aphasia (Section 4.5.2.4). Briefly, the resource generator provides the energy that makes activation available to the language processing system. If this supply of activation is reduced or compromised (be it through fatigue in people without brain injury or resulting from aphasia), word production may be affected. For example, if items in L1 have higher resting levels of activation than L2 items, reduction of available activation might not greatly impact on L1 word production, but might greatly impair L2. Conversely, L1 also requires sufficient means to inhibit L2. Without this, uncontrolled code switching may occur (Green, 1986).

3.7 Interactive accounts of bilingual word processing

More recent attempts to model word production in bilinguals have also been strongly influenced by progress in the study of unilingual language processing (such as Dell *et al.*, 1997; see Section 2.6). Consequently, interactive accounts of language

processing have been proposed to contrast with the serial models. Indeed, the question of whether a bilingual has one lexicon or two is considered to be too broad (Snodgrass, 1993) and the focus has shifted to exploring what is active in bilingual language processing. For example, in a naming task, what else (such as semantic competitors and lexical equivalents in non-target languages), in addition to the target, receives activation? As in the unilingual interactive models, the key contrast with the serial accounts is that of spreading activation. Whereas Green's model in Figure 3.1 predicts a single output from the semantic module that in turn activates a single lexical item, in interactive accounts, activation spreads through the system activating (to various extents) a number of lexical items and phonemes. In Figure 3.2, the various semantic nodes that combine to represent the concepts associated with table (e.g. 1. a piece of furniture, 2. supported by vertical leg/s, 3. has a flat horizontal surface, etc.) sends activation to related lexical items in *both* languages (that is, all lexical items that correspond to 'a piece of furniture' receive some activation; those that correspond to more activated semantic nodes – e.g. chair – will be more highly activated). The 'winner' from this competition for activation should be the target, as, despite all the alternatives (in both the target and non-target languages) receiving activation, the target should receive the most activation of all and is consequently produced.

Costa, Caramazza, & Sebastián-Gallés (2000) provide compelling evidence supporting the idea of spreading activation. They explored picture naming in Catalan-Spanish bilinguals and found that cognates (e.g. Catalan: gat, Spanish: gato ['cat']) were named faster than non-cognates (e.g. Catalan: taula, Spanish: mesa ['table']). The authors interpret this faster latency for cognates as a result of the extra activation the target receives resulting from the activation cascaded to the lexical equivalent in the non-target language. That is, for the Spanish target 'gato', the lexical equivalent in the non-target Catalan ('gat') provides reinforcing activation at the phonological level. Activation for both 'gato' and 'gat' will be high as these lexical items correspond strongly to the activated semantic nodes. As activation cascades through the system, the phonemes /g/,

/æ/, and /t/ will receive an extra 'burst' of activation through the non-target lexical equivalent and consequently facilitate word production more quickly than non-cognates, which do not receive as much activation via the non-target language.

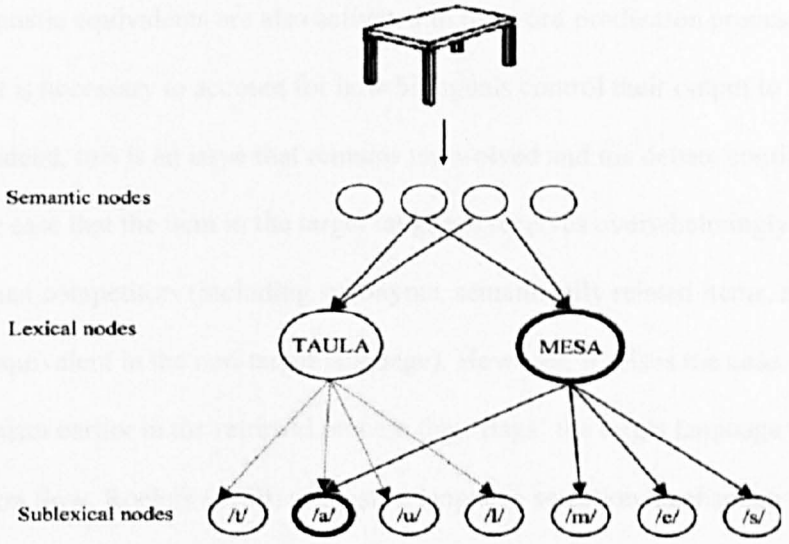


Figure 3.2: An interactive schematic representation of lexical and sublexical access. The Catalan–Spanish pair *taula–mesa* ('table') is illustrated. Activation is indicated by arrows (Costa, Caramazza, & Sebastián-Gallés, 2000).

For example, for the Spanish target 'mesa', activation flowing through the Catalan lexicon will only provide extra activation for /a/, via the lexical equivalent 'taula'. Consequently, the latency for 'mesa' is longer than for 'gato' in Catalan-Spanish bilinguals (the researchers matched targets for word frequency across the two languages, so this difference is not simply a frequency effect). Several studies have demonstrated an advantage of cognates over non-cognates in a range of lexical tasks including word reading, lexical decision and translation (Gerard & Scarborough, 1989; de Bot, Cox, Ralston, Schaufeli, & Weltens, 1995; Ferrand & Humphreys, 1996; Dijkstra, Grainger, & van Heuven, 1999; de Groot, Borgwaldt, Bos, & van den Eijinden, 2002). However, it is difficult to account for this cognate effect using the serial model, as it predicts that only one lexical item (i.e. the target word in the target language) is selected and consequently activated.

A final issue to raise here is the question of how a bilingual ensures the production of the target word in the target language. Code-switching is entirely normal in

conversations between people who are bilingual in the same languages (Grosjean, 1982; Milroy & Muysken, 1995; Auer, 1998) yet bilinguals rarely code-switch when communicating with people where only one language is mutually spoken (Milroy, 1987). If cross-linguistic equivalents are also activated in the word production process in bilinguals, it is necessary to account for how bilinguals control their output to the target language. Indeed, this is an issue that remains unresolved and the debate continues. It could be the case that the item in the target language receives overwhelmingly more activation than competitors (including synonyms, semantically related items, as well as the lexical equivalent in the non-target language). However, if this is the case, there must be a mechanism earlier in the retrieval process that 'flags' the target language to facilitate this activation flow. Roelofs (2000) suggests a language selection mechanism that only considers activation of items in the target language, although Gollan & Kroll (2001) acknowledge that evidence regarding the function of such a control mechanism remains limited.

Alternatively, Dijkstra and colleagues (Dijkstra & Van Heuven, 1998; Djikstra, Van Jaarsfeld, & Ten Brinke, 1998; Dijkstra & Van Heuven, 2002; Van Heuven & Dijkstra, 2003) have developed a model of word recognition that includes a language node in its structure that ensures the target language is produced by inhibiting the non-target language. Their 'Bilingual Interactive Activation' (BIA) model developed ideas from McClelland and Rumelhart's (1981) interactive activation model of (unilingual) language processing (also influential on the unilingual interactive action model discussed in Section 2.6) that resulted in a model of bilingual word recognition. The model has evolved over the last decade and has been presented in a number of formats (BIA, BIA+, BIA++) (references above). The most recent version of this model, SOPHIA – 'Semantic, Orthographic, and Phonological Interactive Activation' (Van Heuven & Dijkstra, 2003) was implemented as a localist connectionist model network and is presented in Figure 3.3.

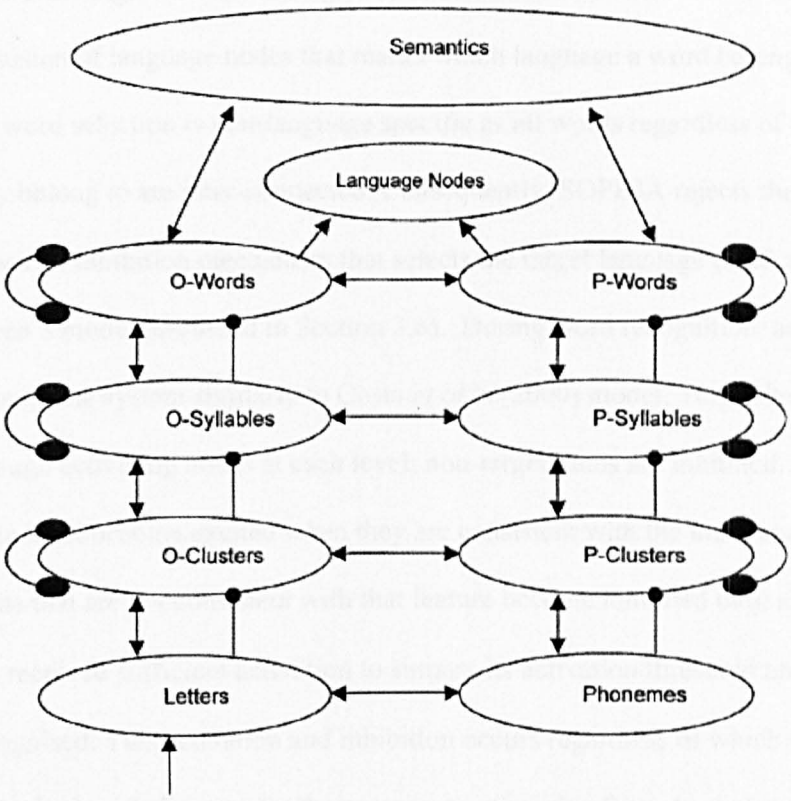


Figure 3.3: SOPHIA: Semantic, Orthographic, and Phonological Interactive Activation model of word recognition (Van Heuven & Dijkstra, 2003; illustration from Thomas & Van Heuven, 2005).
1. O = Orthographic.
2. P = Phonological.

SOPHIA is a model of bilingual word recognition and consequently has not yet been developed to account for word production (although see suggestions in Kroll and Djikstra, 2002). However, it includes within its structure mechanisms that could help to account for the problem of how a language is selected as discussed above. In addition to a level of shared semantics, the model includes an integrated lexicon that contains all words from all languages spoken by an individual (in contrast to the independent lexicons in Costa *et al.*'s (2000) model). This phonological lexicon includes four layers of nodes: words, syllables, clusters and phonemes. A parallel orthographic lexicon also includes four layers of nodes, each of which are directly linked to the equivalent level of phonological processing. A further level of processing termed language nodes represent a tag that indicates to which language each in the lexicon word belongs. These language nodes can also inhibit words of other languages to reflect a stronger representation (e.g.

L1 words might be more strongly represented than L2 equivalents). However, despite the inclusion of language nodes that marks which language a word belongs to, competition for word selection is non-language specific as all words regardless of which language they belong to are inter-connected. Consequently, SOPHIA rejects the notion of a powerful inhibition mechanism that selects the target language (such as the Specifier in Green's model discussed in Section 3.6). During word recognition, activation cascades through the system similarly to Costa *et al.*'s (2000) model. Target items are selected through activating nodes at each level; non-target items are inhibited. Features at each node level become excited when they are consistent with the input and subsequently items that are not consistent with that feature become inhibited until a lexical candidate has received sufficient activation to surpass its activation threshold and is subsequently recognised. This activation and inhibition occurs regardless of which language the items in the lexicon belong to. Furthermore, activation also flows back down the network to reinforce representations at lower processing levels (i.e. phonemes activate p-clusters which activate p-syllables which activate p-words, but p-syllables, p-clusters and phonemes whose features are consistent with the activated p-word become reinforced by activation flowing back down through the network once the p-word has become activated).

3.8 Picture naming in bilinguals without brain injury

The focus of the current study is on picture naming in bilingual aphasia. Current understanding of picture naming in unilinguals both with and without aphasia was reviewed in Chapter 2. Before considering picture naming in bilingual aphasia, it is informative to consider how bilinguals without brain injury perform in picture naming studies.

The Snodgrass & Vanderwart (1980) pictures have formed the basis for several studies of picture naming in bilinguals. These pictures were, of course, developed for and standardised on American English speakers. Section 2.2.3 made it clear that norms collected for this picture set in other languages found different levels of name agreement

and difficulty (measured through collection of latency data) when compared to the original English data. The participants in these studies were reported to be unilingual speakers of the target language, although one might question if some or even all of the participants in some of the studies presented in Table 2.1 were in fact bilingual. Certainly, one might anticipate that many of the Dutch and Icelandic speakers of Martein's (1995) and Ind & Tryggvadottir's (2002) studies respectively were in fact bilingual, simply because many people in these countries speak more than one language.

In any case, Schreuder & Weltens (1993) recognised a need and called for normed stimuli standardised on specific subgroups of bilingual populations. Clearly, even without considering subgroups, the potential combination of languages in bilingual populations is huge, but a number of studies have presented naming data collected from bilingual participants.

Roberts & Bois (1999) collected naming data in English using a selection from the Snodgrass & Vanderwart set on French-English bilinguals. They allocated their participants to two groups based on self-rated proficiency in both languages. English name agreement data from the balanced proficiency group were similar to Snodgrass & Vanderwart's (1980) original data but were significantly lower for the French dominant group. These data therefore indicate that name agreement is correlated with language proficiency. However, some questions regarding these data remain. The researchers only included 100 of the original 260 pictures, but they do not give details of which pictures formed their set. They certainly were not randomly selected as half were cognates and the other half noncognates (in fact cognateness had no effect on name agreement). It would be beneficial to know if the targets were chosen for their cultural appropriateness to the bilingual population being tested. Likewise, the researchers make no mention of the range of word frequency in their selection, which may have impacted on their results. In their exploration of picture naming in Spanish-English bilinguals, Goggin, Estrada, & Villarreal (1994) found that name agreement decreased with self-rated proficiency in both languages, but the deterioration in name agreement was significantly greater in Spanish

than in English, regardless of language dominance. The researchers suggest that this difference could be because the Snodgrass & Vanderwart set was developed for English speakers.

There are other data that indicate that no matter how proficient in L1 or L2 a bilingual may be, s/he will still name fewer pictures correctly than a unilingual participant. Both Kohnert, Hernandez, & Bates (1998) and Roberts, Garcia, Desrochers, & Hernandez (2002) carried out the BNT (Kaplan, Goodglass, & Weintraub, 1983) with groups of English-Spanish bilinguals. Both studies acquired similar results: English-dominant bilinguals named fewer pictures in English than English unilinguals. The order of difficulty of the items was also different for the bilingual groups. As the original test was carried out in full in both studies, the researchers did not 'edit' the test to remove potentially culturally unsuitable targets. Consequently, they attribute the differences in performance to a combination of cultural, linguistic and experiential factors rather than bilingualism *per se*.

In addition to name agreement potentially being different in proficient bilinguals compared to unilingual speakers, there is also evidence that bilinguals name pictures more slowly than unilinguals even in their dominant language. Gollan, Montoya, Fennema-Notestine, & Morris (2005) found that even in their dominant language, bilinguals named the Snodgrass & Vanderwart pictures significantly more slowly than unilinguals. Additionally, they found that mean reaction times for their bilingual group were no slower than the unilingual group when carrying out a semantic classification task. Consequently, the researchers attribute the slower mean naming latency for the bilingual group to processes of lexical retrieval, rather than reduced overall speed of processing. That is, a bilingual's lexicon will contain many more words than a unilingual's; therefore it is unsurprising that it takes a bilingual a bit longer to find and produce a target word than a unilingual.

3.9 Summary

In this chapter, some important aspects that are relevant to the field of bilingualism have been introduced. It is clear that bilingualism includes a continuum of language proficiencies; therefore participants with a range of (in the case of aphasic participants, pre-morbid) language abilities were expected to take part in the project. Models of bilingual word production have been introduced that are strongly influenced by the serial and interactive unilingual models reviewed in Chapter 2.

Despite traditionally negative attitudes towards bilingualism, evidence indicating that bilingualism can in fact be advantageous is growing. Indeed, some of the advantages discussed above might even give bilingual people with aphasia advantages over unilingual peers. For example, if bilingualism does indeed result in above-average communication skills as De Zulueta (1984) suggests, these skills (especially if they are metalinguistic and therefore potentially less vulnerable to aphasia) might be advantageous during SLT. Likewise, if bilinguals also have above average empathy and patience (*ibid.*), facilitating communication when experiencing word finding difficulties might also be propitious.

As bilingual people without brain injury perform differently to unilinguals on picture naming tasks, even when the language tested is the L1, it is not appropriate to make use of standardised aphasia tests where the normed data do not reflect the language acquisition history of the target population. As no aphasia tests have been developed (to my knowledge) for bilingual speakers of Bengali and English, it will be necessary to develop novel tests of word finding as part of the current project.

The study of bilingual aphasia will now be considered, focussing on issues regarding the assessment and treatment of word finding impairments and reviewing the various types of impairment that have been reported in bilingual people with aphasia. Evidence from studies of bilingual aphasia will be used to evaluate models of bilingual word production.

4 Bilingual aphasia: Assessment and rehabilitation

4.1 Introduction

The first studies of bilingual aphasia were published in the nineteenth century (e.g. Ribot, 1882; Pitres, 1895), yet the field is far from well-established, and has been described as neglected and chaotic (Ardila, 1998). Roberts (1998) identifies the need for more attention to be given to the field, but accepts that research in bilingual aphasia is problematic and difficult to carry out; Huitbregtse & de Bot (2002) also suggest that recruiting bilingual aphasic participants can be difficult (although see Fabbro, 1998, who argues that our understanding of bilingual aphasia is not as limited as Roberts suggests). This section will review key studies of bilingual aphasia. It will focus on issues of assessment and treatment, and reported patterns of bilingual language impairment and recovery.

4.2 The "laws" of Ribot and Pitres

Ribot (1882) was among the first researchers to assess recovery in bilingual aphasia. From his clinical observations of a small group of bilinguals, he suggested that one's earliest learned language would show the most recovery. This became known as "Ribot's law", and is still used in current terminology in the field.

Following a similar study based on clinical observations, Pitres (1895) agreed that in most cases of non-parallel recovery (already a minority), Ribot's law would apply. However, he also suggested that in a minority of cases, it will not be the bilingual's L1, rather the most familiar or predominantly used language that makes the best recovery. This alternative, where 'strength of habit' (Davis, 2000) influences language recovery, became known as "Pitres' law". However, in their review of published cases of bilingual aphasia, Albert & Obler (1978) concluded that Pitres' law did not apply above chance level. Furthermore, all of Pitres' cases had learned all their languages in childhood. Paradis (1995a) suggests that for the language of the environment to impact on recovery, it appears that patients need to have come into contact with the language during childhood.

4.3 Assessment of bilingual aphasia

A systematic assessment of all the languages spoken by an aphasic client is clearly an essential element of SLT. Despite this, until recently, many SLTs working with bilingual people with aphasia only assessed their own language (which was often not the patient's L1). Paradis (1995b:219) unequivocally condemns this practice: "It is no longer ethically acceptable to assess aphasic patients on the basis of the examination of only one of their languages". Data obtained from an assessment contribute to a diagnosis, indicate areas of focus for therapy, and can be used to monitor recovery (Fabbro, 2001). However, this is an area that is extremely problematic and consequently underdeveloped. Indeed, Peña-Casanova, Lluent, & Böhm (2002:207) suggest that "assessment becomes truly complex when working with bilinguals". For example, the SLT might not speak one or more of the client's languages; there might not be testing materials available for all of the languages spoken; cultural differences might render one's testing procedures invalid or inappropriate. Clinicians need tests that are valid & reliable and linguistically adequate for each of a bilingual client's languages (Peña-Casanova *et al.*, 2002). Even if it is possible to carry out a full speech and language assessment in all of the client's languages, it might not be clear what the results mean for the client, as it might be difficult to establish how competent he or she was in the various languages pre-morbidly. Consequently, in clinical practice, many SLTs do not assess all languages spoken by a bilingual client, or if they do, assessments developed either for unilingual speakers or for other languages are modified and used informally (Grosjean, 1989). This section will outline the challenges of bilingual assessment and review studies that have attempted to overcome these difficulties.

4.3.1 Establishing pre-morbid history

Collecting data regarding a potentially aphasic client's pre-morbid language use clearly plays a key role in identifying a language impairment. For example, if a bilingual speaker of Bengali and English scores highly on an object naming test in Bengali but poorly in English, his or her performance can not be interpreted as an aphasic impairment

without knowledge of language use before illness. The client might have learned only Bengali as a child and learned some English as an adult after immigration. Even then, it is entirely possible that he or she learned only a few words of English, while Bengali remained the dominant language in his or her environment. If that was the case, the client's L2 performance on the aphasia tests may be entirely unaffected by his or her illness, or at least reflect pre-morbid ability. Grosjean (1989) argues that every bilingual person will have a unique linguistic configuration and is not the sum of two complete or incomplete unilinguals. It is therefore entirely inappropriate to make assumptions regarding pre-morbid language use and it is necessary to develop a profile of language skills before illness.

Although it may be possible to obtain recorded evidence of a client's pre-morbid language use (such as a home video or a letter written by the client), many researchers (e.g. Paradis & Libben, 1987; Grosjean, 1989; Roberts, 2001) advocate the use of an interview with the client and his or her family to establish a pre-morbid language profile. Previous researchers have mainly utilised one of two methods to collect these data. Clients can self-report pre-morbid language proficiency and usage in response to a questionnaire (Albert & Obler, 1978; Muñoz, Marquardt & Copeland, 1999). Alternatively, clients can use scales to self-rate their language skills (Hamers & Blanc, 1989; Roberts & Le Dorze, 1998). In both methods, carers and family members of the client can contribute as appropriate. Involving family in the information gathering process can be useful. They can give a different perspective to that of the client him or herself and give a potentially vital insight regarding the client's communication difficulties within the family. As part of the Bilingual Aphasia Test (BAT), Paradis, Libben, & Hummel (1987) developed a questionnaire that made use of a combination of these methods. Clients and their families report details regarding birthplace, family background, education, occupation, and context and age of languages learned. They also self-rate their pre-morbid ability, frequency and location of use for all their languages in receptive and expressive, spoken and written modalities.

Paradis & Libben (1987) emphasise that such an interview must be carried out by an interviewer who is a competent speaker of the target language. This may seem obvious, but he reports that language testing was often carried out by people who were not fluent in the target language. As a SLT working in London, the current researcher has never encountered a clinician attempting a speech and language assessment in a language s/he does not speak. The danger today is more likely to be that assessment using potentially untrained allies (even in multicultural London, accessing a trained bilingual interpreter is certainly not a given) may result in misinterpreted responses or culturally biased assessments.

4.3.2 Cultural bias and 'sensitivity'

Languages are not spoken in a cultural vacuum (Roger, 1998); therefore SLT assessment must take account of social and cultural factors to avoid potential bias. That is, clinicians need assessments that discriminate only the areas for which they were designed, i.e. normal from pathological language, and do not discriminate either for or against a client for cultural reasons (Taylor & Payne, 1983; Greenfield, 1997). Payne & Taylor (2002) define culture as "the set of values, beliefs, perceptions and institutions held by the members of a particular group of people".

Cultural bias in testing, especially in healthcare and education, is an area that has received a lot of attention over the last two decades. Early approaches advocated learning aspects of the cultural background of an ethnic minority to increase awareness of the needs of the client group (Garrish, Husband, & Mackenzie, 1996). However, learning about a culture can lead to stereotyping of clients from ethnic minority communities (Hall, 1996; Modood, Berthoud, Lakey, Nazroo, Smith, Virdee, & Beishon, 1997; Nazroo, 1997; Gunaratnam, Bremner, Pollock, & Weir, 1998; Culley & Dyson, 2000). Sweeting & West (1995) warn against reducing one's concept of the culture of an ethnic minority group to a collection of behaviours that differ from the ethnic majority. Indeed, Donovan (1984) notes that early attempts to understand the role of culture not only emphasised 'unusual' practices of ethnic minority groups but also implied that such

characteristics were somehow 'deviant' from the allegedly healthy norms of the ethnic majority. This 'fact-file approach' has also been derogatively named the 'Lonely Planet guide to cultural sensitivity' (Culley, 2000). Indeed, the term 'cultural sensitivity' itself, once considered to be entirely relevant (Leininger, 1978) is now itself often considered inappropriate.

Rattansi (1994) discusses the 'post-modern' condition of continuous cultural change. Discussing health services for ethnic minorities, he challenges the idea that identities are made up of fixed essences that can somehow be 'learned' and stresses that health workers cannot assume in advance whether the most important influence on a patient's care will be their nationality, food preferences, kinship relations, religion, skin colour, gender, age, sexual orientation, or socio-economic background. Each patient must be asked to express his or her individual needs. With this insight, argues Rattansi, the term 'cultural sensitivity' becomes undermined. Indeed, many sociologists (such as Jenkins, 1997; Ahmed, 2000; Culley, 2000) reject the idea of ethnicity as culture and ethnic groups as cultural groups; therefore ethnicity alone does not equal a stable set of core cultural norms, values, or beliefs.

4.3.3 Bias in assessment tasks and materials

Tasks and test procedures may be seen very differently by people from different cultures (Ardila, 1995; Roberts, 1998). Researchers in the first half of the twentieth century realised this weakness, and strove to make their tests 'culture-free' by 'removing' aspects of (any) culture (Pérez-Arce, 1999). Later researchers realised that culture is not a veneer that can be penetrated but permeates all aspects of behaviour; therefore the emphasis shifted to developing 'culture-common' assessments that could be validly carried out with people from any cultural background (Carter, Lees, Murira, Gona, Neville, & Newton, 2005). However, this approach was also rejected, as it became clearer that a single assessment could not be universally applicable to all cultures, and cultural background will inevitably impact on behaviour (Anastasi & Urbina, 1997). Most research exploring the impact of culture on test scores has been carried out with children.

For example, Boivin (1991) found that Zairian children performed worse than age-matched American children on non-verbal tests of cognitive ability designed to be culturally fair. Most of these tests, although constructed with the intention of avoiding cultural bias, originated from the developed western world. Indeed, the very idea of testing may itself be vulnerable to cultural bias. Mulenga, Ahonen, & Aro (2001) administered a neuropsychological assessment to Zambian children. The children were instructed to perform as quickly as possible, but most worked slowly and methodically. Peña, Quinn, & Iglesias (1992) found that Puerto Rican children performed better on tasks requiring picture description than picture naming. The authors discovered that picture naming was an activity not normally taught in home or community settings and consequently an unfamiliar task for these children. Indeed, Serpell & Deregowski (1980) suggest that the ability to recognise and interpret pictures is a culturally restricted perceptual skill.

SLT assessments often assess comprehension by testing the participant's ability to follow instructions, yet these instructions may entail bias. For example, common test instructions such as 'Put the spoon in the cup' may not have the same level of difficulty when testing a client from an ethnic minority community as when assessing someone from a white British background. In the west, the instruction is predictable, as spoons often go in cups. Context would therefore assist carrying out the request. In some (e.g. South Asian) cultures, there is a less strong connection between the two objects, as milk and sugar are less commonly added to drinks in a cup. Such an instruction may seem absurd, whereas in the west it is an entirely predictable direction (Speech Therapists' Special Interest Group in Bilingualism, 1992).

Helms (1992) outlines what she terms the Eurocentric values and beliefs that have influenced many cognitive and language assessments. Emphasis on individual achievement, competitiveness, the value of speech, adhering to time schedules, logical thought and objectivity, and quantifiable performance are values central to the western

approach to assessment. Although these values may appear acceptable to those from a western culture, it is entirely feasible that such values may be culture specific.

In their review of cross-cultural assessments of speech and language, Carter *et al.* (2005) suggest guidelines for developing and using culturally appropriate assessment tools. Although their review focussed on paediatric assessment, many of their recommendations are equally valid when considering testing adults:

- Assessments must be developed in collaboration with mother tongue speakers of the target language who are therefore familiar with the target culture.
- Assessments should be piloted on a representative sample of the population.
- Mother tongue speakers and members of the target ethnic group should be trained to carry out or assist in the assessment procedure.
- Clients should be assessed in their home environment, where possible, to minimise the unfamiliar aspects of the assessment situation.
- Trial items and prompts should be used as appropriate to clarify the test tasks.
- In tasks where performance is timed, the cultural view of speed and performance should be considered.

4.3.4 Linguistic issues with bilingual assessment

Measuring and comparing impairments across the languages spoken by a bilingual client is methodologically difficult. Even an assessment of spoken nouns is complex. It is argued that a number of psycholinguistic variables such as word frequency and age of acquisition impact on naming difficulty in unilingual speakers (see Section 2.2.2). These variables will not be identical across languages and it is unclear how they might impact on assessing bilingual aphasia. Indeed Peña-Casanova *et al.* (2002) suggest that psycholinguistic variables are not always considered in most test adaptations. Many studies of bilingual aphasia (e.g. Junqué, Vendrell, Vendrell-Brucet, & Tobeña, 1989; Stadie *et al.*, 1995) do not address this difficulty (or if they have, they have not reported their findings). The problem is multifactorial. Psycholinguistic variables such as spoken word frequency are collected from (assumed) unilingual speakers of the language. Even if

psycholinguistic variables are available in the languages of a bilingual client, it is unclear how these unilingual data impact on bilingual language use. A number of factors may make unilingual psycholinguistic variables inappropriate for bilingual research. For example, age of acquisition values might be applicable to bilinguals due to varying ages and patterns of language acquisition. Likewise, bilinguals are likely to have varying patterns of language usage, i.e. some vocabulary may be more commonly used in one language than the other. Consequently, familiarity values collected from unilingual speakers might not be relevant to bilinguals. Furthermore, bilingual people are not necessarily equally literate in the languages (indeed, some languages, such as Sylheti, do not even have a written form). This may also impact on the applicability of word frequency values, which are typically based on a written corpus. Both Hinckley (2003) and Edmonds & Kiran (2004) developed a noun naming test for English and Spanish where target items were matched in the two languages, but there is no evidence to suggest that this results in a test where targets are equally difficult in both languages. At best, matching word frequencies across languages can be considered as a rough guideline towards a balanced assessment (Roberts & Deslauriers, 1999).

Matching psycholinguistic variables is problematic when these data are available in both languages spoken by a client. Most languages for which psycholinguistic data are available are, unsurprisingly, those spoken in developed countries with an academic tradition. These data are unavailable for most languages spoken in developing countries (and consequently the languages often spoken by ethnic minorities in the UK); therefore matching psycholinguistic variables across target languages (however rough a guideline that may be) will be difficult. However, in their study of oral reading in bilingual aphasia, Weekes, Su, Yin, & Zhang (2007) argue that studies that fail to control for a range of variables are likely to provide weak evidence. In their study, they matched AoA of the two languages spoken by participants (Mongolian and Chinese) by only recruiting participants who acquired literacy in the two languages at the same age (as children), thereby controlling for AoA effects of L2 on performance. They also only included very

common word targets (i.e. high frequency, even though a corpus in the two target languages may not have been available) in their experiments, which they argue minimises the effects of potentially different pre-morbid proficiency in the two languages.

Cross-linguistic comparisons become more complex still when working with sentences. Clearly, different languages may use different constructions to convey the same idea. It is unclear, therefore, how best to develop assessments of syntactic comprehension that can be reliably used in a cross-linguistic comparison. Paradis (2001) suggests that rather than simply translating test sentences, sentences of equivalent grammatical complexity should be used. However, it is not immediately clear how one can reliably match different grammatical constructions in different languages. Consequently, many studies of bilingual aphasia have restricted their enquiries to single word naming and comprehension. This indicates that although bilingual aphasia study is not a new field it is still underdeveloped. Peña-Casanova *et al.*'s (2002) call for the necessity of bilingual aphasia tests to identify both structural characteristics of the target languages and the need to define specific psycholinguistic characteristics of test items remains a goal for future research.

4.3.5 Using and adapting existing aphasia tests

A wide range of assessments of aphasia for unilingual (especially English) language users has been developed. Adapting these for bilingual speakers might appear to be an obvious solution to the problem of the lack of availability of appropriate bilingual assessment materials. However, using translations of existing tests for bilinguals is also problematic. Aphasia tests translated into other languages are generally standardised for native unilingual speakers and not for bilinguals (Miller, 1984). Consequently, the translated test is not a useful tool for bilingual aphasia assessment as the relationship between unilingual norms and bilingual people is unknown. The translated test and the original may not be of equal difficulty; therefore assessing levels of impairment in bilingual aphasia may be invalid (Roberts, 1998).

The BNT (Kaplan, Goodglass, & Weintraub, 1983), probably the most widely used confrontation naming test in the western world (Barker-Collo, 2001), illustrates the problems both of using norms and test adaptations. The original version was published with normative data collected from unilingual American English speakers. Subsequent studies have indicated that these norms cannot be used with unilingual English speakers from different cultural backgrounds, such as Australian (Worrall, Yiu, Hickson, & Barrett, 1995) and New Zealand (Barker-Collo, 2001). Even with American unilingual English speakers, the original norms are inappropriate when assessing people of different race (Lichtenberg, Ross, & Christensen, 1994; although see Henderson, Frank, Pigatt, Abramson, & Houston, 1998, for evidence to the contrary), educational backgrounds (Neils, Baris, Carter, Dell-Aira, Nordloh, Weiler, & Weisiger, 1995), and age (Ivnik, Malec, Smith, Tangalos, & Peterson, 1996).

The BNT has also been adapted for use in a number of other languages such as Dutch (Mariën, Mampaey, Vervaet, Saerens & De Deyn, 1998), Greek (Patricacou, Psallida, Pring, & Dipper, 2007), Korean (Kim & Na, 1999) and Swedish (Tallberg, 2005). However, although the BNT was the starting point for these versions, they have been modified to reflect the target culture with different target words and different or modified pictures. This makes cross-linguistic comparison largely inappropriate and is a difficulty often encountered with test adaptations (Saenz & Huer, 2003; Stokes & Duncan, 1989). Normative data published with these adaptations have also generally been collected from unilingual speakers of the target language, rendering use of the test with bilingual people potentially invalid. Indeed, when studies have compared scores of non-brain-injured bilingual speakers' performance with unilingual norms (both in the original and the various adaptations), the bilingual group scores have generally been significantly lower than the unilingual norms and the order of difficulty has also not matched unilingual rankings (Kohnert *et al.*, 1998, Roberts *et al.*, 2002). This is a strong indication that although adaptations of the BNT can be used with bilingual people, the norms cannot be applied.

4.3.6 The Bilingual Aphasia Test

The BAT (Paradis, Libben, & Hummel, 1987) stands out as an aphasia assessment tool specifically designed for bilingual rather than unilingual speakers. It has been published in over 60 different languages (although not Bengali) and assesses all language modalities. The test consists of three sections. The first takes the form of a questionnaire that evaluates a client's language acquisition history and pre-morbid patterns of language use. The second is a systematic assessment of each language spoken by the client. The third tests a client's translation abilities. The authors stipulate that each language should ideally be tested at the same time on different days and each version should be administered (where possible) by someone unfamiliar with the other languages spoken by the client to avoid confusing normal with pathological code-switching behaviour. The authors claim that each version of the test is culturally and linguistically appropriate to the target language (i.e. it is not simply a translation of the original) and offers an opportunity for cross-linguistic comparison of a client's extant language abilities. Norms exist for each version of the BAT, and the authors suggest that any normal speaker (including L2 speakers with 400 hours or more of instruction) should perform at ceiling on most tasks.

As one of the few assessments developed for bilingual speakers, the BAT is without doubt a useful resource. However, it is not without its weaknesses. The languages in which a version of the BAT is available have been largely guided by which researchers have been willing to develop the test. This has resulted in the BAT being available in some languages with a relatively small number of speakers, such as Friulian (Paradis & Fabbro, 1993) a language spoken by about half a million people (FLW, 2003b), yet is unavailable in Bengali, a language spoken by around 200 million people worldwide (FLW, 2003a).

Paradis (2001) claims that the BAT versions are equivalent in each test language and therefore withstand cross-linguistic comparison. However, it is not apparent how the BAT achieves this goal. Each version is modified to account for cultural and linguistic

differences, which results in different targets, grammatical constructions, and pictorial stimuli. Additionally, in the absence of psycholinguistic data for most of the languages available in the BAT, it is unclear how targets have been identified or matched.

Evidence does not support Paradis & Libben's (1987) claim that native speakers or L2 users with at least 400 hours of instruction should perform close to ceiling in the battery. Manuel-Dupont, Ardila, Rosselli, & Puente (1992) suggest that local norms are needed, as their group of unimpaired Spanish-English bilinguals from Cuba (who met the L2 instruction criterion) scored outside the normal range on 6 subtests in Spanish and 2 in English. Muñoz & Marquardt (2008) found similar evidence of lower scores in Spanish in a group of adult Spanish-English bilingual Mexican-Americans without brain injury, despite Spanish being L1.

Huitbregste & De Bot (2002) also question Paradis & Libben's (1987) claim that 400 hours of instruction will be reflected as the equivalent of a native speaker performance in the BAT. They carried out the BAT with 15 Dutch-English aphasic bilinguals and found that the group's Dutch (native language) scores were overwhelmingly higher than English in all modalities. They suggest that rather than each member of the group suffering a differential impairment, the profile of the group simply reflects pre-morbid skill. When taking account of pre-morbid proficiency (gained from the participants' self-rating of pre-morbid language skills), the assessment data of 12 members of the group indicated a balanced impairment. Huitbregste & De Bot (2002) also suggest that the cultural content of the test may be inappropriate for speakers of that language as an L2 who are not necessarily members of the cultural group for which the test version has been developed.

4.4 Working with bilingual coworkers and interpreters

For most SLTs, assessing all languages spoken by a bilingual client will require assistance from an ally who speaks the client's language not spoken by the therapist (American Speech-Hearing Association, 1985). Ideally this would be a professional with experience of both working in health professions and language assessment (Letts, 2001).

However, in the NHS at least, having access to such a professional is by no means guaranteed. Even in a culturally diverse area such as London, many NHS Trusts covering this area do not fund access to bilingual coworkers. Consequently, many SLTs use clients' family members and volunteers to facilitate speech and language assessment. Indeed, Wiener, Obler, & Taylor-Sarno (1995) consider using family members as interpreters to be an asset. Using family members as interpreters in assessment does have some advantages. For example, a family member is likely to speak the same dialect as the client, and the client will probably feel comfortable working with a familiar face. However, from the perspective of a SLT wishing to gain accurate assessment data, the disadvantages largely outweigh these strengths. Family members are unlikely to be familiar with language assessment and they may not fully understand the importance of maintaining a consistent test administration. They may also be more liable to provide cueing and extra assistance as they may not want the client to 'fail' a test; they will also be unlikely to understand the implications of providing this assistance. Indeed, although the SLT will brief the family member regarding these issues and the procedure for the assessment, it may not be immediately clear (if he or she is a L2 speaker of English) that he or she has sufficiently understood the instructions. Likewise, when translating a production task, there might be a tendency to 'tidy up' the aphasic person's output and not convey all errors. It may also be distressing for the family member to play a role in exposing the full extent of the client's language difficulties (Roberts, 2001).

Although interpreters and bilingual coworkers are likely to be competent speakers of both the assessment language and the SLT's language, working with these professionals is not without its challenges. Indeed, Rowell & Rack (1984) suggest that being fluently bilingual "is no more qualification to interpret than being able to write is to be a secretary". Although some interpreters are trained to work in health professions, the needs of SLT assessment are highly language sensitive and are much greater than acting as general hospital interpreter. It is essential that the interpreter is fully briefed in advance of the assessment session to discuss aims, tasks and procedures to be carried out. A de-

briefing session to clarify the assessment data is no less important (Langdon & Quintanar-Sarellana, 2003).

Barnett (1989) emphasises the importance of ensuring that both client and interpreter speak the same language variation or dialect. Regional variations are not necessarily mutually intelligible; therefore speaking the same 'language' may not guarantee comprehension. Even if the interpreter speaks a dialect that is intelligible to the client, but not his or her native dialect, the interpreter is less likely to be accepted as an ally. One must also be aware that the interpreter's age, gender, religion and social caste or class may impact on the assessment situation. As the interpreter is often likely to be (and ideally would be) a member of the same ethnic minority community as the client, it is imperative that the interpreter is fully aware of the importance of maintaining confidentiality. Finally, Faust & Drickey (1986) assert that some interpreters may feel reluctant to identify language impairments. The authors suggest that identifying the client's 'deviations' from normal language use might be a breach of their professional code of ethics (e.g. National Council on Interpreting in Health Care, 2004).

4.5 Impairment and recovery in bilingual aphasia

Many researchers over the last century have focussed on identifying and categorising different patterns of impairment and recovery in bilingual aphasia (e.g. Paradis, 1977, 1998, 2001; Albert & Obler, 1978; Fabbro, 1999; Roberts, 2001). This review will focus on Roberts' system. It is relevant to note that no evidence has been reported identifying a correlation between site, size, or origin of lesion and the resulting language impairment (Paradis, 1995b).

4.5.1 Patterns of impairment in bilingual aphasia

Roberts (2001) outlines five categories of impairment in bilingual aphasia:

4.5.1.1 Parallel impairment

All languages spoken by a bilingual person with aphasia are impaired in the same manner and degree. As many bilingual people will not have been equally proficient in all their languages pre-morbidly, parallel impairment will not necessarily result in the same

residual language abilities in a client. If a bilingual person was more proficient in one language before onset of aphasia, that language would remain the strongest in a parallel impairment.

4.5.1.2 Differential impairment

In a differential impairment, one language is more severely impaired than another. That is, the type of difficulties will be similar across languages, but the deficit will be more severe in one or more languages than another. Unless the pattern is very gross, assessment using reliable tests of equal difficulty across languages is imperative, as is establishing pre-morbid language abilities and acquisition history. Junque, Vendrell, & Vendrell (1995) report cases of bilingual aphasia who demonstrated differential deficits despite learning both languages simultaneously in childhood. Conversely, Muñoz & Marquardt (2003) suggest that one of their participants had a differential impairment despite having similar test scores in two languages (both significantly lower than mean scores of control participants without brain injury). They suggest that the participant's pre-morbid language history indicated a dominant language, therefore, in the absence of a differential impairment, one would expect that language to have remained the dominant language post-onset of aphasia.

4.5.1.3 Differential aphasia

This term refers to a different type of aphasia in each of a bilingual person's languages rather than a cross-linguistic differential level of severity. For example, one might have the symptoms of Wernicke's aphasia in one language, yet have the characteristics of Broca's aphasia in another. Albert & Obler (1978) and Silverberg & Gordon (1979) presented cases of differential aphasia. One might suppose that it would be less problematic to identify a differential aphasia in comparison to a differential impairment, as a difference would not depend on the severity of an impairment, but it is possible that an aphasic impairment may manifest itself differently in different languages. Furthermore, Paradis (1997) has suggested that the above two studies might equally be interpreted in terms of differential recovery of the two languages or, indeed, differential

pre-morbid ability. Miceli, Silveri, Romani, & Caramazza (1989) report a case of an English-Italian bilingual who omitted free morphemes in English, a common characteristic of non-fluent aphasia, but made substitution errors in obligatory bound morphemes in Italian. Paradis (1997) argues that such a case is not an example of differential aphasia, rather a language impairment that results in different symptoms in different languages depending on the grammars of those languages and/or pre-morbid ability.

4.5.1.4 Blended or mixed pattern

Cases with a blended pattern of impairment mix features of their languages at all linguistic levels (i.e. phonological, morphological, lexical, syntactic, and semantic) and have been reported by Perecman (1984) and Fabbro (1995). This is not simply a case of code-switching, which can be appropriate when speaking to other bilingual people (see Section 3.7). Rather, blended impairment is a pathological combination of various features from the languages spoken by a bilingual person with aphasia. Whereas certain syntactic constraints for permissible code-switching in people without brain injury have been proposed (e.g. the government model, Di Sciullo, Muysken, & Singh, 1986; the matrix language framework model, Myers-Scotton, 1993; the free morpheme and equivalence constraints, Poplack, 2000), aphasic people with a blended impairment do not always conform to follow these constraints. Consequently, Grosjean (1989) emphasises the necessity of using unilingual testers in assessment, where possible, to differentiate pathological from normal language mixing.

4.5.1.5 Selective aphasia

In contrast to the above categories, selective aphasia results in only one of a bilingual person's languages being affected. The other language remains entirely unimpaired and performance will therefore mirror pre-morbid ability in that language. Cases of selective aphasia are highly unusual in the literature, but Paradis & Goldblum (1989) report a case of selective aphasia in a right-handed 25-year-old man following an operation to remove a right hemisphere cyst. The patient was trilingual; Gujarati was his

home language, but Malagasy was the dominant environmental language and French the language of education and the only one in which he was literate. In an assessment following his operation, only Gujarati was impaired, but French and Malagasy remained at pre-morbid levels. Given the difficulties of comparing impairments across languages (Section 4.2), one might question the reliability of the assessments of Gujarati and Malagasy, as neither author spoke these languages and the aphasic person's sister translated assessments. However, it would appear that the differences in the participant's ability to use Gujarati compared to his other languages was marked; therefore it seems less likely that unreliable assessments resulted in the disparity. It is also noteworthy that this person's aphasia was complex. A follow-up assessment carried out 18 months later indicated that his impairment was also antagonistic, as this phase of testing indicated that his Gujarati had dramatically improved, whereas his Malagasy was severely impaired. Four years after his operation, the participant had fully recovered the full use of all his languages.

4.5.2 Patterns of recovery in bilingual aphasia

Roberts (2001) suggests five patterns of recovery from bilingual aphasia:

4.5.2.1 Parallel recovery

Here, all of an aphasic bilingual's languages recover at an equal rate to the same extent. Pre-morbid proficiency will of course impact on a parallel recovery, i.e. a dominant L1 will remain dominant in parallel recovery, but it will not become any more or less dominant than it was pre-morbidly.

4.5.2.2 Differential recovery

In differential recovery, one language improves more than others relative to pre-morbid skills. Although differential recovery often results in the L1 improving more than later learned or less dominant languages (Fabbro, 1999), this is certainly not always the case. Cases have been reported of L2 recovery exceeding recovery in L1, even when the L2 is far less familiar to that person (Aglioti, Beltramello, Girardi & Fabbro, 1996). Some special cases have been reported where languages learned formally (e.g. liturgical

languages such as Latin (Grassett, 1983) or Hebrew (Schwalbe, 1983), or classical languages such as ancient Greek (Pötzl, 1925) have recovered better than the L1. This may reflect the differences between implicit and explicit learning discussed in Section 3.2.

Factors impacting on recovery are numerous and their interaction is complex; therefore this will be given more consideration in Section 4.5.3. Although cases have been reported of recovery of a "lost" language following hypnosis with people with mental illness (Fromm, 1970; Ghilarducci, 1983), the researcher is unaware of a case of recovery of a lost language following onset of aphasia.

4.5.2.3 Successive recovery

Paradis (2001) suggests that if a person speaks more than one language, recovery of each language does not necessarily happen simultaneously. He suggests that one language may "maximally recover" (p. 70) before recovery of the other (or another) language begins. Roberts (2001) notes that one can not determine when maximal recovery has been reached, but a client could reach a plateau in the recovery of one language before recovery in another begins. Cases of 'pure' successive recovery have been rarely reported, but Fabbro & Paradis (1995) and Junqué *et al.* (1995) have both reported cases where this pattern of recovery occurred. Indeed, in Paradis' (2001) review of recent cases of bilingual aphasia, only 4% of cases indicated a successive recovery. Acknowledging that there is likely to be a bias towards publishing unusual cases, the actual incidence of this pattern is likely to be lower still.

4.5.2.4 Antagonistic recovery

The term antagonistic recovery is given to cases of bilingual aphasia where, as one language improves, the other deteriorates. This pattern of recovery is rare, but cases have been reported by Minkowski (1933), Zaorski (1952), and Chlenov (1983). The age of these papers and the rarity of reports of more recent cases is telling. I have been unable to identify more recent cases of a pure antagonistic recovery, although the case reported

by Paradis & Goldblum (1989), cited above as a case of selective impairment is the most likely example.

A variant of this pattern has been termed alternating antagonism, and is applied to cases when the antagonistic pattern alternates, sometimes on a daily basis. This effectively means that a patient could present with mild difficulties in the L1 with a severe impairment in the L2 on one day, but could present with entirely the opposite pattern of difficulties the next. Cases of alternating antagonism are exceptional. Paradis, Goldblum, & Abidi (1982) and Nilipour & Ashayeri (1989) have reported case studies, although identifying the alternation of difficulties relies on somewhat anecdotal descriptions.

4.5.2.5 Selective recovery

Selective recovery occurs when only one of the languages spoken by a person with bilingual aphasia shows improvement. Charlton (1964) and Nair & Virmani (1973) both report cases of selective recovery. This can also be paradoxical, i.e. recovery occurs in the less proficient language pre-morbidly (Aglioti & Fabbro, 1993).

4.5.3 Factors impacting on recovery

Analysing recovery in bilingual aphasia is truly complex. Indeed, it is difficult to identify predictive factors of recovery in unilingual aphasia (Demeurisse & Capon, 1987; Holland, Fromm, DeRuyter & Stein, 1996); therefore it is unsurprising to find that this is also the case with bilingual people. Numerous factors that may influence recovery have been proposed and it is also likely that there is an intricate interaction of these factors that is not yet understood. The complexity of this interaction means that recovery is very difficult to predict, and there are almost always cases in the literature that contradict each influencing factor that has been suggested. To date, no single principle has been formulated that can be applied to all cases of bilingual aphasia (Paradis, 1998; Fabbro, 1999). However, many researchers have suggested variables that could influence recovery. Some of these variables are difficult to measure; therefore evidence often relies on anecdotal descriptions. The age of these studies and paucity of more recent papers

exploring variables impacting on recovery also indicates the difficulty of reliably establishing a link between variable and recovery. Nevertheless, variables suggested as impacting on recovery have included:

- Degree of severity: Based on his clinical observations, Pötzl (1925) suggested that severity of impairment influenced recovery. That is, there is a greater chance of non-parallel recovery in more severe cases of bilingual aphasia than in cases with mild difficulties.
- Emotional attachment: Patients may recover the language they feel most attached to. This will often be the language associated with their home culture, but may also be associated with a language spoken in a happy period of one's life (Minkowski, 1963).
- Will and desire to improve: Halpern (1949) reports a case where the need to speak to one's unilingual children influenced language recovery. Halpern's case was an English-Hebrew bilingual person with aphasia whose initial profile indicated a differential impairment, with Hebrew the most affected language. His children spoke only Hebrew, and the patient found the difficulty communicating with his family exceptionally frustrating. Over time, Hebrew recovered at the expense of English. One could equally argue that the environmental language influenced recovery here. That is, one assumes that in addition to the desire to improve, the children must have provided a language stimulus that in effect provided a rehabilitative activation of that language. Conversely, Ovcharova, Raichev, & Geleva (1968) report a case where a man was unable to talk to his unilingual wife following onset of aphasia, yet that language showed only limited improvement over the course of the study.
- Literacy: T'Sou (1978) suggests that the languages in which a person with bilingual aphasia is literate will indicate the best recovery.
- Age at impairment: In their review of published cases of bilingual aphasia, Albert & Obler (1978) found that "Pitres' law" could be applied in a significantly higher number of cases where the client was below 60 years old than those over 60 years. They suggested that patients over age 60 years were less likely to recover the

predominantly used language before their L1. Although it is difficult to reach a definitive conclusion based on these data, the authors suggest that there may be an interaction of declining memory with patterns of recovery from aphasia.

- The language spoken to the client in the hospital environment or in acute SLT (Lebrun, 1982; Bychowsky, 1983).
- Language acquisition history: Kainz (1983) suggested that in some cases, languages learnt in education whose use was not automatic would show the better recovery. That is, the less automatised language would recover better than the L1 (Gomez-Tortosa, Martin, Gaviria, Charbel, & Ausman, 1995; Fabbro & Paradis, 1995). This factor also reflects the distinction between implicit and explicit learning (Section 3.2) and Zurif & Blumstein's (1978) suggestion that although metalinguistic knowledge may be vulnerable to some other deterioration, it is not vulnerable to aphasia.
- Structural similarity of languages spoken: Minkowski (1963) suggested that languages that are closely structurally related may have an antagonistic relationship in bilingual aphasia. That is, structurally similar languages may require more resources to inhibit the non-target language than in bilinguals who speak structurally distant languages. This might result in a differential recovery of structurally similar languages. Conversely, others have proposed what is essentially the opposite hypothesis, i.e. that differences in recovery are due to structural differences in a bilingual's languages (Ovcharova *et al.*, 1968; Lebrun, 1976).

Roberts (2001) notes that there is little evidence in the literature regarding incidence of the various impairment and recovery patterns observed in bilingual aphasia. The information currently available suggests that a parallel impairment and recovery are by far the most common. Paradis (1977 and 2001) and Albert & Obler (1978) reviewed published cases of bilingual aphasia. They found that most cases (between 40 and 60%) recovered their languages in parallel; other impairment and recovery patterns were less common. There is also evidence supporting this position elsewhere in the literature (Nair & Virmani, 1973; Junqué *et al.*, 1995; Fabbro, 1999; Fabbro & Frau, 2001). Roberts

(2001) also suggests that parallel impairment and recovery patterns are in fact more common than published cases indicate. This is because researchers have tended to publish exceptional or atypical cases.

4.6 Word finding difficulties in bilingual aphasia

Anomia is an almost universal symptom in unilingual aphasia (Kohn & Goodglass, 1985; Bates & Goodman, 1997; Davis, 2000). It is also evident that word finding difficulties are common in bilingual aphasia and that the types of difficulties encountered by unilinguals (e.g. making semantic and phonological errors) can also occur in aphasic bilinguals (Stadie *et al.*, 1995). However, bilingualism can result in additional types of error not found in unilinguals. Code switching is normal behaviour when bilinguals who speak the same languages speak to each other (Section 3.7), but this can become pathological in aphasia (Section 4.5.1.4). That is, aphasic bilinguals might produce the semantic equivalent of the target word in the non-target language that is not spoken or understood by the interlocutor (Marty & Grosjean, 1998; Muñoz *et al.*, 1999). Aphasic bilinguals can also produce semantic, phonological and apparently unrelated errors in the non-target language, as well as mixing languages at the sublexical level, e.g. producing a root from one language with the suffix from another, blending syllables from different languages, or producing the target in one language but pronouncing the syllables as though they were from another language (Perecman, 1989).

Section 3.6 outlined evidence that strongly (if not unanimously) supports the notion that semantic processing is completed centrally, while lexicons may be organised independently on a language-specific basis. It is necessary to consider how this might impact on word naming errors in people with bilingual aphasia. If semantic processing is indeed centralised, a person with a semantic impairment should make similar errors regardless of the target language. That is, a semantic impairment will impact on both languages, as semantic data are accessed from the same semantic module for naming in all languages spoken. Conversely, it is more likely that an aphasic bilingual person with a lexical impairment would present with a more differential naming performance. In other

words, a different module might process lexical items for L1 than for L2 (this is illustrated by the bilingual processing model presented in Figure 3.1). If these modules are truly independent, it must be possible for one module to be damaged in aphasia while the other remains intact. Such an impairment might result in difficulties accessing lexical items in one language while access to another remain undamaged. However, such consideration might come with Ellis & Young's (1996) proviso raised in Section 2.7 that mixed symptoms arising from multiple processing impairments are far more likely to be encountered and such a pure module-specific impairment will only be rarely encountered.

Ferrand & Humphreys (1996) report strong evidence of a central semantic impairment in a bilingual speaker with aphasia. They report data collected from JM, a native English speaker who spoke high level French (he had written a postgraduate thesis in French) before suffering a left-hemisphere CVA. JM scored poorly on a number of tasks requiring manipulation of phonology (e.g. phoneme to grapheme matching, assembling phonology of non-words, identifying whether two presented object pictures began with the same sound). The researchers posit that low scores on these tests indicate minimal access to output phonology and limited apparent internal phonology. Consequently, they suggest that JM needed to draw on conceptual semantic knowledge to carry out auditory word to written word matching, as his ability to derive phonological information from print was impaired. JM performed auditory word to written word matching tasks using a range of language combinations (auditory-written word matching in both French only and English only, auditory French-written English, and auditory English-written French). After testing JM with a range of semantic categories and repeated trials, the researchers found that he demonstrated a category specific deficit that was consistent regardless of the language combination being tested. JM also demonstrated refractory behaviour during both within language and cross-linguistic testing (i.e. his performance significantly deteriorated during repeated trials), but only on tasks where access to semantic representations was required. This is strong evidence of centralised semantic processing: JM demonstrated a similar category-specific deficit across

languages; therefore this implies that he accessed the same semantic representations regardless of which language was in use. Furthermore, as JM demonstrated the same refractory behaviour across languages on tasks requiring access to semantic representations, this indicates that those representations are stored centrally and the same conceptual representations are accessed regardless of which language is in use.

There is also growing evidence that aphasic bilinguals are more likely to name words that have cognate status (word pairs that have the same meaning and a similar phonological structure in two languages, e.g. English: 'book', German: 'Buch') than non-cognates (Ferrand & Humphreys, 1996, Roberts & Deslauriers, 1999). This has implications for testing. If cognates are not controlled for when developing bilingual naming tests, words may be included that have a 'special' status that makes them easier to name than non-cognates. Including cognates in bilingual naming tests also raises issues regarding scoring responses. For example, if words with cognate status are also homophones in the two languages, it is unclear which lexicon the participant has accessed to produce that word. That is, in contrast to words that are not cognates (where the correct response can only arise as a result of accessing the target language), it is difficult to identify which lexicon has been accessed to produce some cognate words and a code-switch may in fact be scored as correct. Likewise, it may be difficult to differentiate a response that may be a code-switching error or potentially a phonological error.

4.7 Rehabilitation of bilingual aphasia

Treatment of bilingual aphasia is an area that has been neglected in research (Fabbro, 1999; Roberts, 2001). Indeed, Paradis (1993) suggested that there was no consensus on how to approach SLT with people with bilingual aphasia or on which types of therapy are most effective. In his review of the field in 2001, he argued this was still the case. This may be due to a number of factors. Studies of unilingual speakers may have carried more prestige or gravitas than those dealing with bilingualism in the past. That is, studies of speakers of an environmentally dominant language might have attracted more funding and interest than research exploring a minority issue. This may have been

especially the case in the United States, where most aphasia research takes place, as multilingualism was considered to be somehow "unpatriotic" for much of the twentieth century following the restricted immigration after the First World War (Bailey, 2004). It is likely, however, that many studies of apparently unilingual people with aphasia have in fact included people with at least some knowledge of an L2, even though this issue has rarely been considered. Likewise, measuring therapy gains beyond the single word level in bilingual aphasia is difficult, as syntax and grammatical constructions may differ across languages depending on their structural similarity. Evidence remains limited, ambiguous, and is often based on small samples.

However underdeveloped our understanding of the therapy process in bilingual aphasia may be, several rehabilitation studies have been published over recent decades, although not all have provided details of what therapy was carried out (e.g. Fredman, 1976) or carried out pre- and post-therapy assessments (e.g. Voinescu, Visch, Sirian, & Maretsis, 1977). Four broad areas are pertinent to this review. First, researchers have examined whether treatment methods that have been shown to be effective in unilingual aphasia can also be effective in bilinguals. Second, studies have explored which of a bilingual client's languages should be chosen for treatment. Third, while treatment in most therapy studies has been carried out directly by a qualified SLT, it is important to know if SLT carried out in collaboration with bilingual allies (such as coworkers, interpreters or family members) can be effective. Finally, studies have investigated if SLT carried out in one language can have a benefit on untreated languages and, indeed, if benefits of treatment do generalise cross-linguistically, under what circumstances this occurs, e.g. if generalisation has occurred only in languages that are structurally similar (Fabbro, 2001; Roberts, 2001).

4.7.1 Treatment methods in bilingual aphasia

It is clearly imperative that a body of evidence is collected indicating which therapies are effective for which bilingual patients in which circumstances (Paradis, 2001). However, a problem with many studies (such as Wender, 1989; de Luca, Fabbro,

Vorano & Lovati, 1994; Junque *et al.*, 1995) exploring treatment in bilingual aphasia is that while they often report an improvement in impairment following therapy, they do not always report what therapy was carried out and consequently are unable to contribute much of value to the evidence of effective therapies. For example, Wiener *et al.* (1995) found that following treatment in English, a group of bilinguals with aphasia (with a range of pre-morbid English abilities) made broadly equivalent gains to those made by unilingual English speakers. Unfortunately, however, the study was retrospective, does not specify what therapy was given to whom, nor does it provide adequate pre- and post-therapy assessment data to justify the claims of equivalent gains.

Elsewhere in the literature, there is a general consensus that therapies that have been effective with unilingual aphasic cases can also be useful for bilingual patients (Juncos-Rabadán, Pereiro, & Rodríguez, 2002; Paradis, 2001; Roberts, 2001). For example Howard *et al.*'s (1985ab) cueing hierarchy was also effective in a French-English bilingual with chronic aphasia (Roberts, de la Riva, & Rhéaume, 1997). Le Dorze, Boulay, Gaudreau, & Brassard (1994) found that semantic tasks typically used in picture naming therapy with unilingual patients (e.g. semantic judgements and word to picture matching) resulted in picture naming improvements in a French-English bilingual with aphasia. Unfortunately, however, the patient in this study was essentially treated as a unilingual. That is, assessment, treatment and reassessment were all carried out in the patient's L1 (French). It is therefore unclear what effect therapy had on the patient's L2, even though significant improvements were made in the L1. Watamori & Sasanuma (1976, 1978) and Sasanuma & Park (1995) found that general language stimulation resulted in gains in both languages spoken by Japanese-English and Japanese-Korean bilinguals with aphasia, although as post-onset time was short in these cases, it is difficult to establish whether the gains were a result of therapy or spontaneous recovery.

Clearly, when speaking to other bilinguals who speak the same languages, the ability to access a target word in the non-target language can facilitate communication, and patients can be trained in SLT to implement this ability as a strategy where

appropriate (Roberts, 2001). There is also evidence (Roberts & Deslauriers, 1999) that some aphasic bilinguals can be trained to use their access to the word in the non-target language as a self-administered cross-linguistic cue to facilitate access to the word in the target language.

4.7.2 Choice of treatment language

The question of which languages spoken by a bilingual with aphasia are most appropriate to treat clearly has considerable clinical implications. SLT clinics in the UK are not often equipped to deliver therapy in languages other than English. Evidence that explores L1 versus L2 treatment outcomes in bilingual aphasia is therefore required. Several researchers have asked this question over the last century, although evidence remains ambiguous.

The decision regarding treatment language is not a dichotomous either/or question, i.e. should L1 or L2 be treated? If one language is treated, should it be the native L1, the least or most impaired language, the most familiar language pre-morbidly, the most important language to the patient, or the environmentally dominant language? Will gains from the treated language generalise to untreated languages? Roberts (2001) argues that when only one language is treated, it is necessary to understand the underlying criteria for this choice. Is the decision to treat a L2, for example, based on the SLT's ability to work in that language or is there evidence to justify this decision? If the patient's L2 is treated in the clinic, could the client benefit from family members carrying out tasks in the L1 at home? If two languages are treated, will they be treated simultaneously or in alternation (i.e a block of therapy in one language followed by a block in the patient's other language/s)? Treatment could also be modality specific (i.e. focusing on writing in one language but on speaking in another). The message Roberts (2001) conveys is that clinicians need to use evidence to lead their clinical decisions, although that evidence may not yet be sufficiently developed to do this.

Early studies such as Chlenov (1983) and Wald (1983) reported evidence (albeit anecdotal) that suggested that SLT should initially only be carried out in the language

showing the most recovery and that treatment in other languages may in fact result in negative inhibitory effects. More recently, Paradis (2001) notes that SLT may have negative effects in some cases of bilingual aphasia, but unfortunately evidence of this is extremely limited. Both Hilton (1980) and Lebrun (1988) advocate treating only one language, at least initially (even though Lebrun himself (1976) reported evidence to suggest that this might result in an inhibitive effect on the spontaneous recovery of untreated languages). This is likely to be the language indicating the better recovery. Hilton (1980) also suggests that if this language is not spoken by the SLT, every effort should be made to accommodate the client's needs. Paradis (1993) advocates initially treating only the language indicating the least impairment until a significant recovery has been achieved. Only then does he suggest treatment in other languages is appropriate.

Decisions regarding treatment strategies in cases of bilingual aphasia have not always been made on evidence-based factors. Early attitudes regarding the choice of treatment language reflected the prevailing attitudes of the importance of immigrant assimilation into the mainstream community (see Section 3.3). For example, commenting on SLT in Israel, Fredman (1976:61) suggests that in cases of bilingual aphasia, SLT should be given in the environmentally dominant language as "it is important that they [the patients] be able to benefit from treatment in Hebrew, which is the country's official language". The possibility that an aphasic patient may have profound difficulties in communicating with his/her own family appears to have been less important. More recently, Harding & Pound (1999) appeared to adopt a similar position when working with a patient with bilingual aphasia (English as L2) in the UK. They acknowledge that the patient's L1 was Punjabi and the language spoken at home with family, but carried out all assessment and therapy in English. However, in this case, it appears that the researchers were restricted to providing treatment in English because of a lack of access to assessment materials and bilingual coworkers to facilitate exploration and treatment in the L1.

Roberts (2001) suggests that although in general, patients with bilingual aphasia will benefit from treatment that provides activation in both languages, there will be some cases, such as a patient with a mixed pattern of impairment, where limiting treatment to one language can be justified. She also suggests (p.223) that in cases with a differential impairment, it may be appropriate (at least initially) to target the least impaired language, as a "basic principle of aphasia therapy is that the patient should be reasonably successful at the therapy tasks".

In the absence of sufficient evidence to base one's decision regarding the treatment language/s, Fabbro (1999, 2001) takes a pragmatic approach. He suggests that a number of factors will lead the clinician's decision: The results of a neurolinguistic assessment of all languages spoken by the patient, clinical and sociolinguistic factors, as well as the wishes of the patient and his or her family, will all impact on the strategy agreed between the SLT and client.

4.7.3 Who carries out the therapy?

All the studies discussed in the previous section have a common factor: All the treatment was provided by qualified SLTs who were either bilingual or unilingual speakers of the treatment language. A problem in the UK is that only 1.5% of SLTs are from ethnic minority communities and most are therefore unilingual English speakers (Thanki, 2002; Madhani, 2004). Consequently, if therapy is to be carried out in a language other than English (in the UK) it is more likely to be carried out either by a bilingual coworker or by patients' family members with the SLT's supervision, than by SLTs themselves. However, very little attention has been given to the effectiveness of this method of treatment delivery. Wiener *et al.* (1995) suggest that therapy carried out by a coworker, even when overseen by a SLT, may not be as effective as when provided directly by a SLT him/herself. Unfortunately they do not provide evidence to justify their position. Evidence is required that explores if SLT can be effectively provided in languages not spoken by the SLT through collaboration with bilingual coworkers.

4.7.4 Cross-linguistic generalisation of therapy gains

A question often asked in studies exploring the rehabilitation of bilingual aphasia is whether gains in a treated language generalise to untreated languages. If robust evidence indicating universal generalisation of therapy gains to untreated languages was available, the decision of which language to treat outlined above would become less problematic. Unfortunately (and perhaps inevitably), available evidence is limited. The difficulty here is similar to that described previously when discussing factors influencing recovery in bilingual aphasia (Section 4.5.3). It is difficult to control for the influences of other variables that might impact on a bilingual client's recovery. That said, researchers have suggested factors that influence cross-linguistic generalisation:

- Semantic vs. phonological therapy tasks – if phonological representations for the same item in different languages access a common semantic representation (see Section 3.6), semantic therapy gains might be more likely to generalise cross-linguistically than phonological therapy (de Groot, 1992; Holm & Dodd, 2001). Furthermore, following evidence that semantic therapy results in generalisation to semantically related items in the treated languages (Drew & Thompson, 1999; Kiran & Thompson, 2003), items that share a semantic representation in bilinguals may result in generalisation to semantically related items in both treated and untreated languages. However, little research has been carried out in this area, although Edmonds & Kiran (2006) report some initial findings. The researchers measured cross-linguistic generalisation following semantic word finding therapy with three Spanish-English bilingual participants with aphasia. The first participant (P1, equally proficient in both languages pre-morbidly) improved naming treated items in the treated language following treatment in Spanish; these gains also generalised to equivalent items in English. P1 did not receive treatment in English. The second and third participants (P2 and P3), both pre-morbidly English dominant, demonstrated cross-linguistic generalisation after treatment in Spanish (P2's naming gains after therapy in English did not generalise to the untreated language and P3 did not receive

treatment in English). The researchers tentatively suggest that these results may indicate that treatment gains are more likely to generalise cross-linguistically when treatment is not carried out in the dominant language. For balanced bilinguals, generalisation is more likely to occur both from L1 to L2 and vice versa, as the strength of connections between semantics and lexicons is more likely to be equal. This exploratory research is certainly of interest, but one must approach these initial data with caution, due to the low number of participants in the study and also because of the small number of test items in each group. The researchers also fail to report any inferential statistics.

- Structural similarity of languages spoken – the term "structural similarity", although implying similarities at the syntactic level, in fact also encompasses similarities in lexicon, morphology and phonology (Watamori & Sasanuma, 1978; Junqué *et al.*, 1989 and 1995; Sasanuma & Park, 1995; Juncos-Rabadán & Rodríguez, 1999).
- Language acquisition history – Kroll & de Groot (1997) and Galvez & Hinckley (2003) suggest that mode of language acquisition or learning may impact on transfer patterns following rehabilitation. That is, if L1 utilises implicit learning and L2 more so explicit learning (especially for adult learners), this may impact on generalisation following treatment.
- Therapy without a specific production component might be more likely to generalise to untreated languages (Laganaro & Venet, 2001).

It is fair to suggest that more research is required to explore this area. Indeed, both Fabbro, de Luca, & Vorano (1996), and Paradis (2001) suggest that gains may cross-linguistically generalise in any circumstances depending on the specific case and at present it is not possible to accurately predict therapy outcomes in bilingual aphasia. Paradis' (1993:86) summary of our understanding of factors influencing outcomes of SLT with bilingual aphasic clients remains relevant: "There is still no consensus on how to approach the rehabilitation of bilingual aphasics... Therapeutic effects on one language may transfer to another in proportion to the structural similarity between the languages or

they may transfer irrespective of structural distance. Moreover, the effects of therapy may transfer in the context of some aphasic syndromes, have no effect in others, and have negative effects in still others".

Finally, another factor that may influence cross-linguistic generalisation of therapy gains is cognate status. Section 3.7 reviewed evidence of cognate advantage over non-cognates in bilinguals without brain injury. There is also a growing body of evidence demonstrating cognate advantage over non-cognates in word retrieval tasks in participants with bilingual aphasia (e.g. Roberts & Deslauriers, 1999; Lalor & Kirsner, 2001). Kohnert (2004) presented a case study exploring the treatment of word finding difficulties in a participant, D.J., with bilingual aphasia. Word pairs received treatment (all items were treated with a combination of semantic and phonological activities) in both L1 (Spanish) and L2 (English). D.J.'s naming of treated items improved for both cognate and non-cognate groups in both languages. However, cross-linguistic generalisation to the untreated language only occurred for the cognate group – cross-linguistic generalisation did not occur with non-cognates. Furthermore, D.J. only demonstrated cross-linguistic generalisation from items treated in L1 to the untreated L2. Clearly, the impact of cognate status on therapy outcomes with bilingual clients needs further exploration, but there is evidence to suggest that cognate status does impact on word retrieval in bilingual aphasia. However, it is also necessary to acknowledge a methodological difficulty here. Word pairs with cognate status (by definition) share a majority of (and sometimes all) phonological features. For example, some of the English-Spanish cognate pairs used by Kohnert (2004) are almost identical: zebra/cebra, train/tren, piano/piano. It may be difficult to identify which language a participant has accessed to produce the target word. Consequently it may be difficult to differentiate a code-switching error from a correct response.

4.8 Summary/review

This section has reviewed the evidence currently available in the field of bilingual aphasia. Despite a long history, the study of bilingual aphasia is both underdeveloped and

complex to carry out. Difficulties in assessing bilingual aphasia have been raised, such as obtaining pre-morbid history, avoiding test bias, and the role of bilingual coworkers in SLT assessment. The reported impairment and recovery patterns have been reviewed and the factors that may impact on recovery explored.

The limited evidence available for rehabilitating aphasic bilingual patients has been evaluated in terms of treatment methods and outcomes for both treated and untreated languages. The current study will add to this evidence by reporting the process of developing culturally relevant tests of word finding for people with bilingual aphasia from London's Bengali community. These tests will be carried out with a group of six bilingual people with aphasia, and the data acquired from these tests will be used to collate a profile of word finding skills for each participant. The study will also provide much needed evidence of carrying out word finding therapy with bilingual aphasia and report outcomes from treatment carried out in two different languages (Bengali and English) using both semantic and phonological therapy activities.

5 The Bengali community in London

5.1 Introduction

Section 4.3.2 outlined the dangers of stereotyping the cultural characteristics of ethnic minority communities. However, as all the participants for the current project were members of the Bengali community in London (and given the current researcher's own prior relative ignorance of that community), it was clearly appropriate for the researcher to acquaint himself with some socioeconomic and cultural aspects of the Bengali community in the early stages of the project. This position is supported by Culley (2000), who accepts that although one must avoid stereotypes and rigid expectations of a member of a particular ethnic group, one also requires sufficient prior knowledge to know what *might* be relevant to a particular encounter. Especially pertinent to the current study, Schieffelin & Ochs (1986) take the position that developing novel cross-cultural assessments necessitates ethnographically based research based on the language and culture. Clearly, some familiarity with the community with whom one is working can only be advantageous, even though such knowledge does not remove the need to work with allies from within the community. This chapter reflects the process of exploring the community and presents a brief summary of what was learned about Bangladesh and Bengali culture.

5.2 The Bengali homeland

The existence of Bengalis as a distinct ethnic group can be traced back many centuries. However, Bangladesh as a nation (which means 'Bengali homeland' in Bengali) had a very recent birth following a long struggle to attain it. As an ethnic group, Bengalis inhabit what is now Bangladesh and the region of India immediately to the west of Bangladesh today known as West Bengal. A map of the country appears in Figure 5.1.

Until the British colonised what is now Bangladesh in the eighteenth century, the area had been under Muslim rule for almost six centuries, first by Turks and Afghans and later as part of the Mughal Empire in the sixteenth century (Virtual Bangladesh, 2003a). The dominance of Islam was strongly established by the time that administration of the

area passed to British rule in 1764. Adams (1987) comments that the British considered Bengal to be a place where vast profits could be made, and the East India Company exploited the agricultural potential of the area. That Bengal had a native population was seen as no more than 'accidental'. The area, especially around Kolkata (now in West Bengal) became an important centre for commerce, culture and education.



(Adapted from University of Texas, 2003)
Figure 5.1: Map of Bangladesh

Following the end of the Second World War, Britain was obliged to relinquish its colonies. The Indian subcontinent was divided into two states based on religion in 1947 – the predominantly Hindi state of India and the overwhelmingly Muslim state of Pakistan. The problem was that the two predominant Muslim areas of the subcontinent (western Punjab and Bengal) were a thousand miles apart. This led to the establishment of West (what is now Pakistan) and East Pakistan (now Bangladesh). The largely Hindu area of West Bengal (including the Bengali cultural centre of Kolkata) became part of the Indian state (Husain, 1991). East Pakistan, described as a 'runt state' (Plunkett, Newton, Wagenhauser, & Murray, 2000), was dominated by and generally administered unfavourably by West Pakistan. Despite the common religion, the increasing

development of Bengali nationalism alienated the West Pakistanis from their poorer Eastern compatriots. Two decades of struggle to achieve independence ensued that resulted in both bloodshed and war crimes, and finally the establishment of the independent state of Bangladesh in 1971. This was not an entirely happy ending for the Bengali people as the country was decimated by war, contaminated water, and a subsequent famine in the early 1970s. Despite an extremely high infant mortality rate (over 10%) and mass emigration, the Bangladeshi state had a rapidly growing population of over 100 million people and remained one of the world's poorest countries (World Bank, 2003). Following a number of military coups, political assassinations and martial law, democracy was finally established in the 1990s, albeit with accusations of fixing and boycotts from some opposition parties. Following improving relationships with the West and the oil-rich Islamic countries, there are currently signs of economic growth in Bangladesh, although extreme poverty has not yet been overcome (Plunkett *et al.*, 2000).

5.3 Historical importance of Bengali in Bangladesh

The Bengali language plays an unusually prominent role in the history of the Bengali people. Bengalis are often fiercely proud of their language and it contributes a strong sense of belonging to a cultural group (Gardner, 2002). However, it was not until the establishment of the state of Bangladesh in 1971 that Bengali became the official language of a Bengali state (Chakravarty & Narain, 1986). Throughout the six centuries of Muslim rulers, although everyday use of Bengali was tolerated, Persian had been the language of administration, and it remained so following the start of British rule in 1764 until 1835, when English became official language of India (Dil, 1991).

Following the establishment of East and West Pakistan in 1947, East Pakistan was pressurised to accept Urdu, the first language of the larger and more powerful West Pakistan, as the official language. Indeed, such pressure from the West Pakistanis made language an important political issue. When a group of East Pakistani students were shot by West Pakistanis for protesting for the right to use their own native Bengali as the state language, the issue of language gave momentum to a liberation movement leading to

eventual independence from Pakistan in 1970/71 (Adams, 1987). The anniversary of this initial protest (21st February) has been named 'Language Day' and is commemorated annually in Bangladesh (Enabling Minority Language Engineering (EMILLE), 2003a). Indeed, the United Nations Educational, Scientific and Cultural Organization (UNESCO) designated this day 'International Mother Language Day' and has been commemorated annually since 1999 (UNESCO, 2003).

5.4 The Bengali language

Bengali is the predominant language of Bangladesh, West Bengal and Tripura in eastern India (Babulanam & Beena, 1999). It is a member of the eastern branch of the Indo-European group of languages and is a descendent of Sanskrit (Dil, 1991; EMILLE, 2003a). Wright (1991) argues that there is a close affinity between Bengali and English. He compares the loss of nominal gender and agglutinative verbal mood in both languages. As a result of the long history of British rule in the region, Bengali has borrowed many words from English. As English continues to become a dominant global language, this pattern of lexical borrowing has continued despite Bangladesh's independence. However, on a structural level the two languages are fundamentally different. Whereas English demands a Subject-Verb-Object word order, the verb is always placed at the end of clauses in Bengali (i.e. Subject-Object-Verb, Subject-Adverbial-Verb, etc; Radice, 2003).

There are currently at least 180 million L1 speakers of Bengali, making it one of the most widely spoken languages in the world. This number appears to be growing quickly, as Beena, Amen, Sayed, & Babulanam (2000) place Bengali as the fourth most widely spoken language in the world, whereas Ahmed (1987) ranked it sixth. Maniruzzaman (1991) suggests that Bengali has surpassed many other Indo-European languages as it has achieved the status of an 'international language', although this may be misleading, as Bengali is not widely used outside South Asia except among migrant groups. Despite the large number of speakers of Bengali, the language has received a relatively small amount of academic attention. Consequently, compared to the psycholinguistic data available for English, data available for Bengali are very limited.

For example, although a word frequency database is available for Bengali (Mallik, Bhattacharya, Kundu, & Dawn, 1998), it is based on a corpus of only 60,000 words. Compared to the corpus of one million words used for the Kučera & Francis (1967) database of English word frequencies, the Bengali database is somewhat limited.

98% of Bengalis speak a form of Bengali as their L1 (the remaining 2% belong to tribal groups, such as the Biharis who, although based in the area, speak a different L1) (Virtual Bangladesh, 2003b). Bengali occupies a position of some prestige in Southeast Asia (Maniruzzaman, 1991). Much of this prestige is because of Bengali's rich literary tradition, which originates from the Mughal Empire and reached its modern pinnacle in the early 20th century, when Rabindranath Tagore (1861-1941) was awarded the Nobel Prize for Literature in 1913. Although Tagore remains a hugely influential figure in Bengali culture (his work receiving a reverence comparable to that of William Shakespeare in British culture), he is certainly not an isolated figure, as literary traditions exist for both Hindu and Muslim communities (Dil, 1991). Despite such an important literary tradition, illiteracy is a major problem in Bangladesh. UNESCO (2003) placed the national rate of illiteracy at 40%; therefore over 50 million people in Bangladesh are illiterate. They also note that females greatly outnumber males in illiteracy. The World Bank (2003) estimates the illiteracy rate to be even higher (59%) when only people over fifteen years old are included. In any case, this is an improvement from the 1980s, when Dove (1983) placed the national illiteracy rate at 78%. In a survey of the Bengali population in Leeds, Tufnell, Nuttall, Raistrick, & Jackson (1994) found that 49% were illiterate in English, while 35% illiterate in Bengali. One might infer from these data that older Bengali populations will have higher rates of illiteracy than younger generations.

5.5 Bengali phonology

It is potentially informative to briefly outline the inventory of Bengali phonemes and consider the nature of prosody in Bengali:

5.5.1 Consonants

The phonemic inventory of standard Bengali consists of 43 phonemes (Radice, 2003). This includes 29 consonants and seven vowel placements, all seven of which can be nasalised, resulting in a total of 14 vowels. Table 5.1 outlines the range of consonants in Bengali.

		Labial	Dental	Alveolar	Apico-Postalveolar	Lamino-Postalveolar	Velar	Glottal
Nasal		m		n			ŋ	
Plosive	voiceless	p p^h	t̪ t̪ʰ		ʈ $ʈ^h$	tʃ $tʃ^h$	k k^h	
	voiced	b b^h	d̪ $d̪^h$		ɖ $ɖ^h$	dʒ $dʒ^h$	g g^h	
Fricative		f		s z		ʃ		h
Liquid				l, r	ɽ			

Table 5.1: Inventory of Bengali consonants.

The range of consonants in Bengali is somewhat richer than English phonology. They are represented using symbols from the International Phonetic Alphabet (as illustrated in Table 5.1). Although Bengali has a richer phonology, there is quite a high degree of phonological overlap between Bengali and English, which could indicate a likelihood of cross-linguistic generalisation of gains from therapy carried out in the current project (reported in Chapter 8). The reader will note that Table 5.1 contains more consonants than the 29 phonemes found in standard Bengali. This is because there are some variations in realisations of even the standard form (Chalmers (1996) notes that phonemic variations found in non-standard variations will be much wider):

- /f/ can be used as an allophone of /p^h/.
- For some speakers, /s/ and /ʃ/ can be used as allophones in some contexts; for others they are phonemically distinct.
- For some speakers, /dʒ/ is an allophone of /z/.
- For some speakers, /r/ and /ɽ/ can be used as allophones in some contexts; for others they are phonemically distinct.

Words native to Bengali rarely contain consonant clusters; syllabic structure can be consonant-vowel, vowel consonant, or maximally consonant-vowel-consonant. However, given the large number of non-native words that Bengali has borrowed (mostly from English and Sanskrit), one finds a range of consonant clusters in the language).

5.5.2 Vowels

Table 5.2 outlines the range of Bengali vowels. It is also pertinent to observe that /o/ is the inherent vowel in Bengali (as opposed to /ə/ in English). This impacts on the current project, as phonemic cues will be realised slightly differently in the two target languages, i.e. a phonemic cue for /b/ in English will be realised as [bə] but as [bo] in Bengali.

	Front	Central	Back
Close	i		u
Close-mid	e		o
Open-mid	æ		ɔ
Open		a	

Table 5.2: Inventory of Bengali vowels.
1. Note that all seven vowels can be nasalised; e.g. /e/ can be nasalised and realised as /ẽ/.

5.5.3 Prosody

Stress in disyllabic Bengali words is generally placed on the initial syllable. In multisyllabic words, primary stress is generally placed on the initial syllable, while secondary stress is added to odd-number syllables (i.e. third and fifth syllables). Dil (1991) notes that as Bengali has borrowed from several languages including Sanskrit and English, there are exceptions to these general patterns.

Intonation generally has little impact on Bengali words, but at the sentence level, pitch is used to indicate the end of a sentence. That is, intonation slowly rises during a sentence until the final word of the sentence, where the pitch is markedly lower to indicate sentence completion. Intonation for questions also generally rises until the final word, which, as in sentences, is also marked by falling pitch, but here the final word starts at a high pitch and falls to a lower pitch, as opposed to the low flat tone of sentences.

5.6 Dialects of Bengali

Bengali has a large number of dialectal variations affecting both vocabulary and grammar. There are a large number of regional variations, but there are also dialectal forms that are used only in literature and on formal occasions. Some of the most important dialects will now be briefly reviewed.

5.6.1 Standard Literary Bengali

Standard Literary Bengali is a highly literary variation that utilises a predominantly Sanskritic vocabulary. Its use is generally reserved for academic writing (Singh & Maniruzzaman, 1983).

5.6.2 Kolkata dialect

Until partition in 1947, Kolkata was the cultural and economic centre for the entire Bengali region. Its local dialect therefore became both prestigious and the standard form. This standardization was further reinforced when Tagore wrote his major works in this dialect. It has been named Standard Colloquial Bengali (SCB) (Grierson, 1993).

5.6.3 Dhaka dialect

After partition, East Pakistan essentially lost its cultural centre, as Kolkata lay in the Indian state of West Bengal. The dialect spoken in Dhaka, the capital city of the new state, emerged as the new SCB of East Pakistan and remains the most prestigious dialect of Bangladesh. It is now considered the standard form and is used in schools, universities, radio, TV and other formal domains (Grierson, 1993).

5.6.4 Sylheti dialect

This is a regional dialect spoken by people from Sylhet, a region in Northeast Bangladesh. As the area is both remote and poor, the dialect has a low prestige in Bangladesh. However, this dialect is directly relevant to this project as 95% of Bengali immigrants living in the UK are from Sylhet and therefore speak this dialect (EMILLE, 2003b). SCB is taught in schools in Sylhet, although Sylheti remains the preferred language of home and informal situations and plays an important role in defining group identity (Quader, 1993). Sylheti has lexical, phonological, morphological, and syntactic

variations when compared to Dhaka SCB although about 85% of the vocabulary is shared (Shivprshanna, 1961; Rasinger, 2003). Despite this shared vocabulary, L1 speakers of SCB sometimes find Sylheti 'hardly intelligible' (EMILLE, 2003b). SCB is generally understandable to Sylheti speakers as it is the national language of education and the media (although this is not always the case: See Chalmers, 1996). Although Sylheti is generally accepted to be a Bengali dialect, some authors have argued that, despite the similarities between SCB and Sylheti, Sylheti should be considered an entirely independent language (Smith, 1985; Chalmers, 1996). However, even within Sylhet, SCB is generally considered to be the more prestigious variation (Edwards, 1994). Indeed, over the course of the current project, several people from Sylhet referred to SCB as "proper Bengali".

There are also regional differences within Sylheti. Chalmers (1996) notes that there is no single 'correct' form and that people from northern Sylhet speak a dialect that is somewhat different to those from the south of the region. Indeed, a rather extreme example is presented by Ali (1979), who lists 52 Sylheti variants of the word for 'now' (SCB: '*akhon*'). His list ends with the word '*ityadi*' – 'etcetera'! Sylheti once had its own writing system but it is no longer taught in schools as Sylheti is primarily a spoken language. Illiteracy in Sylhet region is higher than in other areas of Bangladesh (Ghuman & Ghallop, 1981), but when Bengali is written, the standard variation is used.

5.7 Sylhet Region

There are fewer schools in Sylhet that in other areas of Bangladesh (Ghuman & Ghallop, 1981). Clearly, this will directly influence literacy, which is lower than the rest of the country (*ibid.*). However, during fieldwork in Sylhet, Gardner (1995) found that many of the people who were unable to read or write Bengali were able to read aloud from the Qur'an in Arabic (without comprehension). Lack of access to education means that those from Sylhet region are less likely to access L2 classes. Consequently, despite English's position as a world *lingua franca* (Grillo, 1989; Bradby, 2000), Sylhet region

has relatively low numbers of speakers of English as a L2, whereas in other areas of Bangladesh, English is widely spoken as a L2 (Ghuman & Ghallop, 1981).

Sylhet region is one of the wettest places in the world. The rainy season is often augmented by bursting rivers; therefore flooding occurs annually, and artificial hillocks holding up simple houses become islands surrounded by water. The flooding occurs on a massive scale (the floodwater can be five metres deep and hundreds of kilometres wide) and renders boats the only means of transport during this season. In addition to human casualties, the flooding regularly destroys roads, bridges and property. Conversely, the floods also bring fertility to the area, where tea and rice are grown in large quantities. Sylhet town itself has developed into a successful and bustling place with its own airport, hospital, schools and colleges. Plunkett *et al.* (2000) note that funding for many of the improvements have come from expatriates living abroad, predominately in the UK. However, due to the nature of the climate and the relative lack of communications, villages that lie as little as twenty miles from Sylhet town remain isolated and unchanged (Adams, 1987).

5.8 Bengali Emigration

Most emigration from the Bengal region occurred in the 1950s and 60s. However, there are records indicating the existence of a small Bengali community in London, now the largest Bengali community outside Bangladesh and West Bengal (Ahmed, 1987), as early as the 1870s (Watson, 1977). Most emigration has been to the UK, although emigration to Burma, Hong Kong, the Middle East and USA is not unusual (Husain, 1991). A combination of factors encouraged emigration:

- Political instability in Bengal, especially after WWII with the partition of India and the establishment of East and West Pakistan;
- The need for labour after WWII, especially in the UK, meant that finding work and gaining the immigration papers was, for a period, essentially guaranteed;

- Natural disasters in Bengal, especially the annual flooding (up to 70% of Bangladesh becomes inaccessible by road during the floods), contributed to extreme poverty in many rural areas (Fyson, 1984);
- A failing economy led to increasing unemployment;
- It became increasingly 'fashionable' to work abroad. *Lascars* (unskilled seamen) were not from the poorest or least educated families (Adams, 1987).

Sylhet region experienced a particularly high emigration rate throughout the twentieth century. This was initially due to two main reasons. First, before the era of widespread air travel, the easiest way to find work away from one's homeland was on the merchant ships of the British Raj. Adams (1987) explains that ships (carrying tea and jute to Europe) passed through Sylhet (then part of the Assam region of British India rather than Bengal) after leaving the main port of Kolkata. This direct link with Kolkata led to a demand for labour as *lascars*, albeit enduring great hardship in poor working conditions (Broeze, 1980). Sylheti men earned a reputation for being able to endure extreme conditions in the engine rooms (Adams, 1987, suggests this was actually fuelled by a desperate need to earn money and that they would work for a lot less than British crews). Second, as Sylhet was part of Assam rather than Bengal, revenue collection was administered differently. Whereas in Bengal local *zamindars* (landlords) collected land rents (and their own cut of profits) on behalf of the British government, farmers in Assam retained ownership of their land and paid taxes directly to the British administrators, thus avoiding paying the *zamindar* his commission. The administrative difference meant that Sylheti farmers were slightly better off than many Bengalis. They were therefore more likely to be able to risk the price of passage to Kolkata in the hope of finding work on a merchant ship. After the partition of India, East Pakistanis were unable to travel to Kolkata (then in the Indian state of West Bengal) without a passport and were thus cut off from their source of employment. The dominant West Pakistan administration made it difficult for East Pakistanis to obtain authority from East Pakistan to travel to the UK.

Many Sylhetis travelled first to West Pakistan (over a thousand miles away) to obtain the necessary authority (Gardner, 1995, 1999).

5.9 The Bengali Community in the UK

The longest-standing and largest Bengali community in the UK (and the largest outside Bangladesh and West Bengal) is centred around the Aldgate area of east London in the Borough of Tower Hamlets (The Economist, 2003). This area has a long history of providing refuge to immigrant groups who have generally moved out of the area as they have become both established in London and wealthier. Bengali immigrants began to arrive in larger numbers in the area in the 1930s (Eade, 1989; Tower Hamlets, 2003). The recent trend within the Tower Hamlets Bengali population is continued growth. A recent census indicated that 34% of the total population of Tower Hamlets are Bengali (National Statistics, 2001b), a proportional increase of 6% in two years (City University Press Archive, 2002).

Most early Bengali immigrants were Sylheti *lascar* seamen. Although the Bengali community in the UK will inevitably have been influenced by British culture to some extent (Young, 1995), the majority of Bengalis in the UK (totalling over 140,000 in London alone) still have connections in Sylhet (BBC, 2003a). This is partly because recruiters for the ships tended to favour members of their own villages (in return for a bribe), and later, settlers brought their extensive families over to join them in the UK (Eade, 1989). Gardner (2002) notes that today many Bengali families living in London can trace their ancestry to these original sailors. In the 1930s, it became increasingly common for *lascars* lured by the promise of wealth to 'jump ship' while in Britain. It should be stressed that these men were not illegal immigrants. As citizens of British India they had every right to live in Britain, although as they had broken their contracts, the East India Company would send them back to work on a ship if they were found. As it was still relatively unusual to find men with dark skin in Britain at this time, these men naturally stuck together, thereby developing a fledgling community (Adams, 1987).

5.9.1 Employment

These early immigrants gained (generally poorly paid) employment in the clothing trade, catering, or working in hotels as porters and in the boiler house (a natural progression for engine room *lascars*). In wartime England, many Bengalis moved to the Midlands for better paid jobs in factories. In the 1950s and 1960s there was a large demand for unskilled workers who would work for poor pay with little job security. Due to their often poor English and literacy skills, Bengali settlers were often forced to accept this type of employment. Taylor & Hegarty (1985) point out that a low income will obviously have major implications for accommodation, education, health and security.

Sylheti-owned 'Indian' restaurants began to be opened in London using money loaned by a large number of Bengalis on a cooperative-style agreement (Hunter, 1962), first to serve the growing Bengali community and later (especially when it was realised one could make good profits) serving the English community.

5.9.2 Socio-economic position

The Bengali community has often been described as the most underprivileged group in the UK (Edwards, 1981; Smith, 1985; Ahmed, 1987; Quader, 1993; Law, 1996; although see Eade, 1989, who argues that a community should not be presented as a single cohesive entity).

A combination of factors contributes to this position:

- Unemployment within this group is the highest in the UK (Bangladeshi Youth League, 1988; Sly, Thair, & Risdon, 1999; Dale, Shaheen, Virinder, & Fieldhouse, 2002). Recent statistics indicate that 25% of Bengali females and 22% of Bengali males are registered unemployed (National Statistics, 2001a). These figures may, however, be somewhat misleading, as up to 70% of Bengali females may be economically inactive (i.e. they are not available for work). If a woman does have a job, this may reflect badly on her husband as her working may be interpreted as a sign of his inability to provide sufficient financial support for his family (Dale *et al.*,

2002). Unemployment is especially high in men over 45 years old, as more than 50% are without employment (National Statistics, 2001a).

- For those who are employed, the average weekly income for this group is the lowest of any ethnic group in the UK (Prime Minister's Strategy Unit, 2004). Jupp, Roberts, & Cook-Gumperz (1982) note that many Bengalis have taken unskilled jobs, especially in manufacturing industries that do not demand a high level of education or qualifications. Brah (1996) suggests that discrimination may also restrict the employment opportunities available. However, as the next generation of Bengalis speak native-level English and receive a generally better education than their parents, there are increasing opportunities available (Eade & Zaman, 1993; Husain, 1991).
- When compared to white British families, Bengali families tend to be larger, which of course results in greater expense for parents (Home Affairs Committee, 1986). Bengalis also often have financial obligations to support their extended families back home in Bangladesh (Taylor & Hegarty, 1985).

5.9.3 Racism

Since the Bengali community began to grow, there have been occurrences and complaints of racism. Indeed, Ahmed (1987) suggested that Bengalis were the worst victims of British racism. There have been many reports of physical attacks on Bengalis, especially (but not exclusively) in London (for example, see Tendler & Reid, 2000; The Times of London, 2003).

Physical attacks on Bengalis in London became so common in the 1980s that some Bengalis set up vigilante groups to control Bengali-dominated areas (Fyson, 1984). Even more recently, Gardner (2002) considers the threat of attack, especially for older people, to be more or less constant. However, more widespread, and with perhaps deeper implications for the Bengali community, is the existence of institutional racism in terms of housing, education, employment, and immigration laws. Smith (1985) considers the existence of institutional racism to be largely undisputed. For example, a British National Party candidate was elected on to the council in Tower Hamlets in 1993 through his

campaign against the Bengali community, although he subsequently lost his seat in the next election (Black to Black, 1997). Indeed, Eade (1989) suggests that as Tower Hamlets has traditionally been an area with a large demand for limited council housing, the Bengali community have sometimes been seen as taking away accommodation from the 'rightful' ethnic majority, resulting in increased animosity towards Bengalis. One should be careful, however, not to give an impression of racism solely from the white community. Griffiths (2003) reported observing regular conflict between Afro-Caribbeans and Bengalis during her own research.

More optimistically, there are promising signs that racism against Bengalis is decreasing. For example, the Education Authority in Tower Hamlets has implemented a project to increase the number of Bengali teachers working in schools. This has already achieved measurable benefits, as Tower Hamlets is today the fastest improving area in the UK in terms of passed GCSEs and A Level exams (Commission for Racial Equality, 2003b).

5.9.4 L2 learning

People from Sylhet do not share the history of learning English as L2 with some other regions of Bangladesh. As a result, as the majority of Bengali immigrants in the UK are from Sylhet region, many arrived in the UK speaking little English. Indeed, MORI (1994) found that 64% of the London Bengali community spoke little or no English. This statistic is likely to be lower today, as second and third generation migrants grow in number. Clearly this has implications for employment opportunities. Indeed, the Linguistic Minorities Project (1985) found that more than a third of London's Bengali workforce were employed in environments where the workforce was entirely Bengali and Bengali was naturally the language spoken. In the current study, one participant explained that he learned fluent Urdu through working in a factory with a predominantly Pakistani workforce for many years but failed to achieve English fluency after living in the UK for over forty years. Indeed, for a community that is "tightly bound within their own group" (Quader, 1993:69), the limited opportunities for linguistic interaction with English

speakers often restricts L2 development. Likewise, as many Bengali women do not work, their opportunities to interact with English speakers and improve their English are very limited. In a study of Bengali mothers, the Inner London Education Authority (1986) found that Bengali women saw learning English as a way of overcoming racism, yet their learning opportunities were limited.

Tomlinson & Hutchinson (1991) note that although Bengali adults often recognise the need to speak English, they feel torn between improving their integration in the society in which they live and the need to protect their own cultural identity by 'being' Bengali. For some, learning English may appear to be a rejection of existing elements in their identity and cultural background, especially when they see their language to be a principle marker of group identity, as is the case with the Bengali community (Hinnencamp, 1980). More recently, Cline & Shamsi (2000) found that this trend within the Bengali community is continuing when compared with the progress of other ethnic minority communities. Ellis (1986) suggests that L2 learning will only take place when the subsequent consequences are seen to be positive. For Bengalis in the UK, the perceived costs in loss of identity must be outweighed by the potential rewards of learning English (such as the promise of a better job).

5.9.5 Housing

The majority of early Bengali immigrants initially settled in the London Borough of Tower Hamlets, an area with a long history of being home to various immigrant communities. Unsurprisingly, it was also an area with concentrations of poor housing. Bengalis were obliged to settle in areas of the Borough offering very poor and generally unsuitable accommodation (Eade, 1989; Rizvi, 1993). Due to the high unemployment within the community, house ownership remains unusual (Gardner, 2002), and there is a continued reliance on council housing, which is, inevitably, in short supply. Consequently, overcrowding is a problem, especially as extended families are brought over from Bangladesh. Likewise, 90% of those registered as homeless are Bengalis, as are 80% of those placed in temporary accommodation (BBC, 2003a). Another difficulty is

that there is a shortage of suitable council housing to accommodate extended families. This shortage has lead to the breakdown of extended families within the community. Gardner (2002) suggests that most Bengalis would prefer to split the family to stay in a 'Bengali' area of the Borough, rather than be moved to a more distant area such as the Isle of Dogs, where the threat of racist attacks appears greater. However, Bould (1990) argues that the perceived threat to personal safety is more powerful than the need to keep one's family under the same roof (see also Husain, 1991, who outlines the concept of extended family common to many South Asian cultures).

5.9.6 Integration

The 'myth of return' is a phrase often used when describing the UK Bengali community (coined by Anwar, 1979). This phrase refers to the persevering dreams of returning home of many immigrants. Quader (1993) explains that Bengali immigrants in the UK were slower than some other immigrant communities in establishing roots and ties in the UK. Most early immigrants were men who intended to earn enough money to allow them a comfortable existence in Bangladesh when they returned. Many who stayed in the UK did not necessarily see this as laying roots, more as delaying their homecoming.

The UK may have been seen as a place where economic needs could be satisfied, but Bangladesh was for most always the spiritual home, even though the increasing Islamicisation of some parts of the UK made it feasible to be a practising Muslim (Gardner, 2002). Consequently, many Bengali men did not send for their wives and families immediately to join them in the UK as they intended to return (see also the descriptions of personal experiences of the myth of return and idealised homeland of Khalique, 2003; and Tarafdar, 2003). This reluctance to give up one's roots goes some way to explaining Punetha, Giles, & Young's (1988) comment that economic incorporation rather than cultural assimilation is the desired goal of this community. However, as changes restricting immigration to the UK approached in the 1970s, many Bengalis chose to bring their extended families to the UK while they were still able to.

However, some men preferred to delay bringing their wives to the UK until they needed them as carers in their retirement.

In Tower Hamlets today, one would be unable to see signs of this initial reluctance to lay roots in the UK. The area around Brick Lane is the flourishing heart of the Bengali community and is a thriving hub of nightlife and cultural events. It was recently christened 'Banglatown' to attract tourists from the parallel 'Chinatown' around Soho (Swadhinata Trust, 2006). Indeed, the best-selling novel 'Brick Lane' (Ali, 2003) was a breakthrough success for British-Bengali writing and was shortlisted for the 2003 Booker Prize, a prominent international award. However, the book also elicited complaints of insult from within the Bengali community (BBC, 2003b).

5.9.7 Health and ageing

Statistics concerning the health of the Bengali community in the UK do not paint a positive picture. Bengalis (with Pakistanis) are five times more likely to be diagnosed with diabetes than white people, and are more likely to have a stroke (Joint Health Surveys Unit, 2001). The incidence of tuberculosis in Tower Hamlets is six times higher than the national average, and Bengalis are more likely to develop this illness than white people (Fyson, 1984). They also have a greater risk of heart disease, not only when compared to white people, but also to other Indian groups and African Asians (Nazroo, 1997). The cause for this vulnerability is multifactorial. In their review of health in the Bengali community, the Commission for Racial Equality (2003a) found that as a group, Bengali men smoke an above average number of cigarettes when compared with other communities in the UK. Nicotine is also taken orally in the form of *paan.* Along with Pakistanis, Bengalis exercised the least, and had the highest fat and sugar levels in their diets. Indeed, Gardner (2002) notes that many immigrant Bengalis modified their home diet, which was high in carbohydrate and fibre (rice and vegetables), to one rich in fat (from large amounts of *ghee*[1] and red meat). This, along with the stress of living a life that may involve poverty, racism and unemployment, may lead to the increased blood

[1] A clarified semi-fluid butter used especially in Indian cooking.

pressure often found in members of some South Asian communities (Miller, 1991; Balarajan, 1991).

Clearly, regardless of ethnic background, deteriorating health often accompanies old age. Indeed, Gardner (2002) warns that rather than only highlighting the characteristics of the elderly in the Bengali community that differ from the stereotype of the UK ethnic majority, one should also stress that much of their experience is shared by many old people in Britain today, such as increased poverty and dependence on the state, in addition to the inevitability of an ageing body. Likewise, by virtue of living in the UK, everyone participates to a degree in mainstream society and its institutions.

However, despite such similarities, there are important differences in how the members of the Bengali community approach old age when compared to the British mainstream. A striking difference is that in Bangladesh, age is not measured by years but by life events (Edmonston & Bairagi, 1981). Birthdays are not celebrated in rural Sylhet, and most elders measure their life not by linear time (birthdates on passports are often entirely arbitrary), but by events such as marriage, parenthood, marriage of children (especially sons), and becoming a widow/er (Vatuk, 1995). One's status in society grows as these life events are experienced. If one develops a progressive illness at an early age, one might take on the dress and attitudes of an elder despite one's age (Gardner, 2002).

Whereas ageing in the UK is often associated with illness, decay, and loss of power and independence, Bengali (predominantly, but not exclusively male) elders have traditionally remained the controllers of the property and finances of the extended family. They often occupy a role of power and status, are often being considered wise and experienced, and are called on to arrange marriages and resolve local conflicts (Bond & Coleman, 1990). Being looked after by one's family when one loses independence is seen as a right rather than a burden. It is also often considered appropriate for an elder to become increasingly traditional and religious. In the UK, this may mean returning to traditional Bengali clothing even if Western clothes have been worn for many years. If religion becomes increasingly important for (some) Bengali elders, a stroke or other

illness might strongly impact on being able to practise Islam in a number of ways, such as attending services and reciting prayers (although Islam does exempt the infirm from many religious duties). The ability to recite from the Qur'an is important. Even if the Arabic text may not be understood, importance is placed on the use of the human voice (Tayob, 1999). A stroke may clearly impact both on phonation and reading aloud. As many Bengali elders retain contact with families back home in Bangladesh, illness may make returning home, even for a holiday, increasingly difficult. If illness results in communication difficulties, even maintaining contact via telephone may become frustrating.

One can clearly see a strong contrast between the roles played by the elderly in Bangladesh and the UK. Bangladesh offers an elder a prestigious social position and the fulfilment of spiritual needs, whereas bodily and material needs are better met in the UK. This contrast becomes even stronger when one learns that many of the early immigrants (some still alive) are regarded almost as folk heroes in their home villages, being the subject of songs and legends, whereas in the UK they live an often anonymous existence (Adams, 1987). Consequently, there may be a mismatch between the deference that some Bengali elders in London expect and what they actually receive.

Gardner (2002) suggests that many elders face a difficult decision on whether to spend their retirement in Bangladesh or to stay in the UK. For many, returning is a realistic option, as many immigrants retained close ties with their home village and family, often investing in the local economy and in local property (Husain, 1991). Many who return are treated as especially experienced as a result of living in the UK, although the contrast in quality of life in Bangladesh (such as finding grit in rice and living with open sewers) may be a deterrent. Attractive as this prestige and status may be, the health services available in the UK, albeit often supplemented by traditional Bengali remedies, may, in comparison to those available back home, provide a very strong reason to stay, especially given the increasing health needs of the elderly. However, there is also growing evidence that ethnic minority communities, especially Bengalis, are not fully

accessing health services (Pharoah & Redmond, 1991; Hill & Penso, 1995; Field, Hockey, & Small, 1997; Lee, Rosenberg, Sixsmith, Pang, Abularrage, 1998; Ahmed, 2000). Bould's (1990) findings that many South Asians are reluctant to ask to be referred to a health service or to discuss some aspects of personal lives (such as intimate tasks of caring) with health professionals will also impact on service access.

Staying in the UK may, however, often mean that an ageing person will not be able to occupy the traditional role of elder that they would back home. For example, in a culture where traditionally it may be considered transgressive for younger family to address elders, young Bengalis born in Britain often fail to show elders the respect they feel they are due (e.g. speaking out of turn, smoking in an elder's presence, not using formal greetings). This may be an influence from British culture, but may also be due to the fact that in the UK, younger family members are not so reliant on the family elder as their main source of income (Gardner, 2002).

Given that the UK's health services may be a major factor in deciding whether to return home or stay, mainstream British society's expectations of the elderly and its influence on the health service may clash with expectations of Bengali elders. In a culture that places a very strong emphasis both on retaining one's independence for as long as possible and striving to overcome disability, health services will often set patient targets that may contrast with an elder's expectations of being looked after by his family (Vatuk, 1990). For example, Gardner (2002:166) reports an interview with a physiotherapist who complained that her biggest frustration when working with the Bengali community was trying "to get people to want to be independent". Bengali elders may become completely dependent on carers after a stroke or major illness and 'surrender' to their disability. The word *Islam* itself means 'surrender' in Arabic (Tayob, 1999). If a Muslim 'surrenders' to an illness or stroke, this may influence motivation to achieve change in SLT and other health services. Likewise, an elder's expectations of family support (and the accompanying reduced independence) may also have religious grounds. Gardner (2002) explains that in many places in the Qur'an, one is beseeched to look after the elderly. If

one fails to, one will be punished on the day of judgement *and* have a disorganised family and society.

Haj is a pilgrimage to Mecca that all Muslims should attend once in their lifetime wherever possible. Attending *Haj* is said to cleanse one's sins. As old age approaches, there may be a reluctance to play a role in public life as spirituality becomes much more important. Adams (1987) describes one elderly Bengali man who was unwilling to participate in her research. He had recently completed *Haj* and felt he had no role to play beyond his spiritual life.

Illness is naturally regretted, but may also be accepted as God's will (Spruyt, 1999). This may be seen as a sign of one's dotage, almost as a status symbol. For example, Gardner (2002) reports a physiotherapist's complaint of many Bengalis insisting on using a walking stick when unnecessary. Likewise, exercise is not always seen as a useful activity to achieve rehabilitation when carers can fulfil one's needs[2]. However, it appears unlikely that Bengali people in London commonly reject treatment[3]. Discussion with Bengali coworkers involved in the current project proved enlightening. One coworker had encountered some people in rural Bangladesh rejecting medical treatment, although she also said there may have been financial implications in addition to any religious conviction. However, none of the coworkers had heard of anyone in London rejecting treatment. Another coworker reported that it is Islamic to keep one's mind and body in good health; therefore accepting treatment or therapy might equally be interpreted to be accepting God's will as much as rejecting it.

5.10 Implications for the project

One must accept that many factors will influence a person's individuality. Indeed, when completing a questionnaire exploring sensitivities to various potentially taboo subjects among people from South Asian communities, Miller, Chavda, & Gadhok (1999)

---

[2] One should add here that a Bengali female informally reported that this is a predominantly male indulgence.

[3] Indeed, in his clinical experience, the current researcher has encountered Westerners who have chosen not to receive SLT. Regardless of ethnicity, accepting treatment is a choice.

found that all items received a very wide range of responses and it is therefore clearly important to avoid preconceptions for any participant. However, by exploring the mainstream culture of a group, one can gain a sense of what may be inappropriate when developing test materials and working directly with members of this group. This chapter was not intended to be a 'beginner's guide' to the Bengali community, it was intended to reflect the process of information gathering that was an integral part of the project.

How might this review of the Bengali community impact on the current project? Clearly, at a macro level, having some kind of awareness of what *might* be relevant to participants, both aphasic and without brain injury, can only be beneficial (as long as a stereotype is not applied indiscriminately). This is a community with a history of political instability, whose first generation migrants left their homeland in search of better lives. Despite the high levels of unemployment, poor housing, and poverty in the UK Bengali community, many would consider themselves to be relatively well-off in comparison to incomes in Bangladesh and consequently have the added pressure of providing some financial support to families back home. The Bengali community in the UK is also vulnerable to poor health, not only in comparison to the white British majority, but also to other ethnic minority communities.

If a CVA results in aphasia, there might be far-reaching consequences. For example, it may be difficult to continue to support a large family, especially if there are financial commitments to supporting family in Bangladesh as well. There may also be a profound impact on one's psychological well-being. Clearly, aphasia can be extremely depressing for all, regardless of ethnic background. However, given the 'myth of return' experienced by many Bengalis, a CVA or aphasia might result in the realisation that returning home is increasingly unlikely. It may also be very distressing to be unable to carry out religious duties or recite from the Qur'an.

At a more practical level, an awareness of the religious duties that many Muslim Bengalis must perform will impact on when participants are available. For example, Friday is the Muslim Sabbath, and is therefore best avoided as a day for appointments.

Also, a sensitivity regarding the five daily times of prayer for Muslims can only be advantageous. It may also be appropriate to avoid contacting participants during religious occasions such as Ramadan. Given the statistics regarding high illiteracy in older Bengalis, establishing literacy (and in which language/s) before attempting any assessment is clearly essential. Likewise, given the range of dialects in Bengali, it is paramount that Bengali-speaking allies who are called upon to assist during sessions with clients speak the same dialect as the participants themselves, especially given Bowen's (albeit 1986) observation that although most Bengali people accessing health services in the UK are Sylheti speakers, most advocates and interpreters are in fact SCB speakers and therefore not necessarily always able to understand the patients.

5.11 Summary/review

Before leading into the main part of the dissertation where methods and findings for the current study are reported, it may be helpful to sum up some of the issues that have been raised over the course of the previous four chapters. Section 2 established that word finding difficulties are common in people with aphasia. It also presented evidence that SLT can be effective in treating anomia with people who speak one language. Chapter 3 identified a need for more research with bilingual speakers. It established that bilinguals perform differently to unilinguals in language tests, which may reflect their different cultural and linguistic backgrounds. This means that even though there is strong evidence of SLT being effective with improving anomia in unilingual speakers, more research is required with people with bilingual aphasia. Chapter 4 reviewed the evidence currently available for bilingual aphasia and highlighted the complexity of the field. It also clarified the need for effective assessment of bilingual people with aphasia, such as obtaining pre-morbid history, avoiding test bias, and the role of bilingual coworkers in SLT assessment. Impairment and recovery patterns in bilingual aphasia were reviewed and the factors that may impact on recovery explored. The current chapter identified the need for evidence of treating bilingual people from London's Bengali community with aphasia. It also explored the cultural, linguistic, and socio-economic background of this

community, and raised implications for the current project. The remainder of this study will now report and discuss the process of assessing and treating word finding difficulties in bilingual people with aphasia from this community.

6 Developing bilingual assessments of word finding

6.1 Introduction

This chapter describes the process of developing aphasia tests suitable for assessing single noun abilities in both oral and written modalities that are linguistically and culturally appropriate to be carried out in both Bengali and English. This included the recruitment of the project consultant and control participants, the recruitment and training of a team of bilingual coworkers, the procedure followed to identify suitable test targets, and test construction.

6.2 Recruitment of Project Consultant

Although the researcher attended a weekly evening course in Bengali at the School of Oriental and African Studies (SOAS) in London in the first year of the project, it was never anticipated that this would result in sufficient knowledge of Bengali language and culture to work unaided. The project budget included funds to allow access to a project consultant. It was envisioned that this person would be a literate member of the Bengali community so that s/he would be in a position to advise on linguistic and cultural issues. It was anticipated that this person would also be able to offer comment and guidance on working with Bengali speakers. This person needed to have some knowledge of linguistics and, as the role would facilitate assessment and therapy in Bengali, ideally be an SLT.

A number of avenues for recruitment of this role were explored. The heads of both the National Special Interest Group in Bilingualism and the Bengali Department at SOAS were contacted to introduce the project and enquire about potential candidates for the role. RCSLT was also contacted, as its register of SLT members includes details of languages spoken by each individual. At the time of enquiry, there was only one SLT on the register who spoke Bengali (although there are now two). This person was contacted, and she agreed to take on the role. Although she was based in Bradford, it was felt that a Bengali-speaking SLT would bring a perspective and understanding of the needs of the project that justified travelling between London and Bradford. Likewise, the consultant

came from a Sylheti background (as do most of Bradford's Bengali community). This is the same area of Bangladesh from which most of the London Bengali community originates. Consequently, the consultant was well-placed to comment on cultural matters from a Sylheti perspective.

6.3 Recruitment and training of bilingual coworkers

It was also necessary to recruit a group of coworkers who spoke both English and Bengali, who would be involved in direct contact with both aphasic and control participants in the project. It was anticipated that the coworkers would also be allies to the researcher, offer ongoing comments and fine-tuning of assessment and therapy sessions, and offer ways into the Bengali community by utilising contacts and potentially identifying project participants. Experience of SLT was not essential (although would obviously have been welcomed). Being fluent in Sylheti-Bengali and English was a key need, as was having the potential to work effectively with people with aphasia and, indeed, other people involved with the project. Rather than employ a single coworker with high availability, employing a small team was preferred for a number of reasons. For example, if one coworker proved unsuitable or left soon after being employed, the project could continue without the need to recommence the recruitment process. Having access to four or five members of the community was also seen as an advantage, both because of the increased opportunities to utilise contacts within the Bengali community as well as having a broader range of linguistic and cultural knowledge to consult. The need for bilingual coworkers would be occasional and sporadic rather than providing any permanent or regular employment, therefore employment on a freelance hourly basis was offered without the promise of regular income.

It was anticipated that local students might have the combination of skills and time availability (and the interest in earning some extra money) that was sought. All members of the bilingual coworker team received clearance to work with vulnerable adults from the Criminal Records Bureau. All of the bilingual co-workers were students at local universities. Two were mature students; therefore an age range of 20-45 years was

represented. All spoke fluent Bengali and came from a Bengali cultural background. However, one of the co-workers came from a West Bengali rather than Bangladeshi family and was included in the project as she was a speech and language therapy student.

6.4 Training of bilingual coworkers

Only one of the five bilingual coworkers had any experience in SLT. Although it was not anticipated that coworkers would work with the participants unsupervised, it was considered advantageous to provide some basic training as an introduction to their roles in the project. All coworkers attended a half-day training session held at City University run by Professor Jane Marshall and the researcher. The session included the following topics:

- What is stroke?
- Disabilities resulting from stroke
- Basic brain anatomy and lateralisation
- Recovery after stroke
- What is aphasia?
- What does speech and language therapy do?
- Introduction to testing to be used with control participants in the project
- Request for potential participants and pooling of possible contacts

The session also allowed the coworkers to test the assessment software and materials on each other and to comment on the suitability of the target words and pictures. Further training and instructions were given as necessary by the researcher to each coworker on an individual ad hoc basis.

6.5 Recruitment of non-brain-injured control group

Twenty people without brain injury were recruited to act as control participants. Control participants were not directly matched to the aphasic group, as no aphasic people had been recruited at this stage. However, it was clearly important that the control group resembled the anticipated aphasic group on a number of variables, including a range of

L2 abilities, education, occupation, and migratory history. As it was anticipated that the aphasic group would be older people, participants over 50 years old were targeted. Although a range of L2 skills was sought (to reflect the Bengali community in London), minimal bilinguals (i.e. those with very limited English knowledge) were excluded. Contact was made with potential participants through a range of sources:

- Posters requesting the need for volunteers were posted on boards in a number of GP surgeries in Tower Hamlets.
- Flyers introducing the project and requesting volunteers were sent to Bengali community groups, community centres, and local libraries.
- Presentations introducing the project and the role of the control participants were given to potential volunteers at community groups and centres that expressed an interest.
- A request for participants targeting NHS employees was placed in staff bulletins at The Royal London, St. Bartholomew's, and Mile End Hospitals.
- The bilingual coworker team suggested potential friends and family who might be interested.

Those who agreed to participate were given an opportunity to ask any questions regarding their role in the project. Participants were given an information sheet in either English or a version that had been professionally translated into Bengali (or both, if they wished) (see Appendices 1 and 2). Each participant was asked to sign a consent form (again in a choice of English or Bengali) that clarified their participation in the project and stressed their right to withdraw at any stage (see Appendices 3 and 4). Each control participant completed the language acquisition history questionnaire (see Appendix 5) from the BAT (Paradis & Libben, 1987). Questions regarding aphasia were removed from the original, as this group had no brain injuries. Participants were not paid for their contribution to the project.

6.6 Demography of control participants

6.6.1 Origin and migratory history of control participants

Figure 6.1 indicates the birthplaces of the control participants. Eighteen were born in Bangladesh. One was born in the UK and moved to Bangladesh with her family as an infant before subsequently settling in the UK. The remaining participant was born in Bombay to Bengali parents whose L1 and home language was Bengali. Mean number of years spent in UK was 23;2 years (range 1-41). Two participants had also lived in other countries where English was the environmentally dominant language (one in Hong Kong for 11 years; another spent 13 years in the USA). Taking this into account, mean length spent in an English-speaking environment was 24;4 years (range 3-41). Seventeen participants moved to the UK directly from Bangladesh.

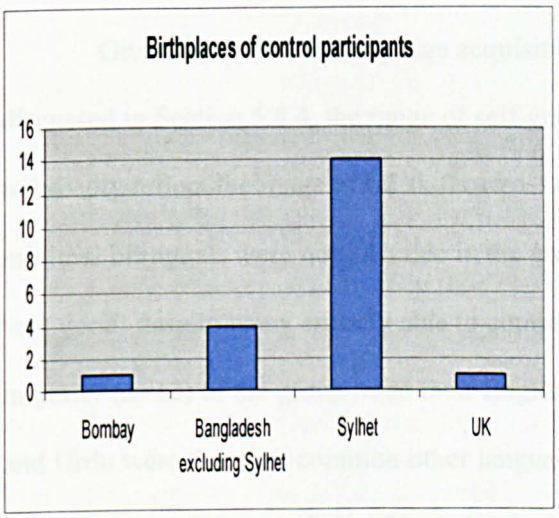


Figure 6.1: Birthplaces of control participants.

6.6.2 Age and gender of control participants

Mean age of the control participants at the time of gaining consent was 49;11 years (range 32;10-63;5). Eight participants were female. All participants were right-handed.

6.6.3 Language acquisition history of control participants

All participants were L1 speakers of Bengali with English learned at some point in life as a L2. None had learned English from infancy; Bengali was the language used by all parents in the home during childhood. Fifteen participants considered Sylheti to be

their L1; Bengali was the L1 for the remaining 5 people. Not all participants made a clear distinction between Sylheti and Bengali. Some called Sylheti "peasant" or "country" Bengali, and made the distinction from "proper" Bengali learned in school.

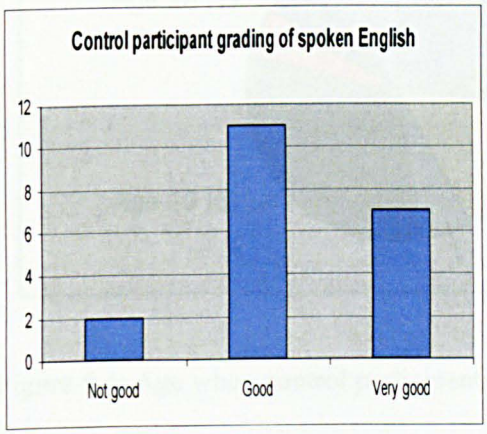


Figure 6.2 Control participants' grading of spoken English.

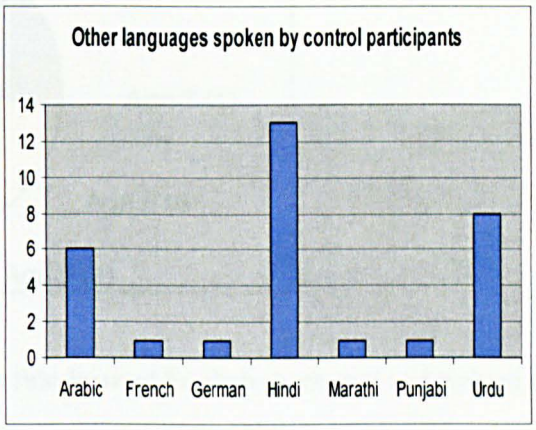


Figure 6.3: Other languages spoken by control participants.

Given the profile of language acquisition for the Bengali community in the UK discussed in Section 5.8.4, the range of self-grading of L2 English abilities can be argued to broadly reflect the range of L2 skills across the community (Figure 6.2). Even though minimal bilinguals were not included in the group, two participants rated their English as 'not good' despite being entirely able to communicate orally with the researcher. The majority (n=12) of the group rated their English as 'good'. Figure 6.3 indicates that Hindi and Urdu were the most common other languages spoken by the group. This reflects their status as *linguae francae* in the South Asian area.

Most of the control group began to learn to read and write Bengali when starting school at age five. The range of ages for learning spoken and written English is much wider, representing the broad range of L2 acquisition histories within the group. Although the acquisition questionnaire asked participants to estimate their age when English speaking, reading and writing were first learned, all participants' responses were identical for each modality; therefore Figure 6.4 reflects the data from all three items regarding English acquisition age in the questionnaire.

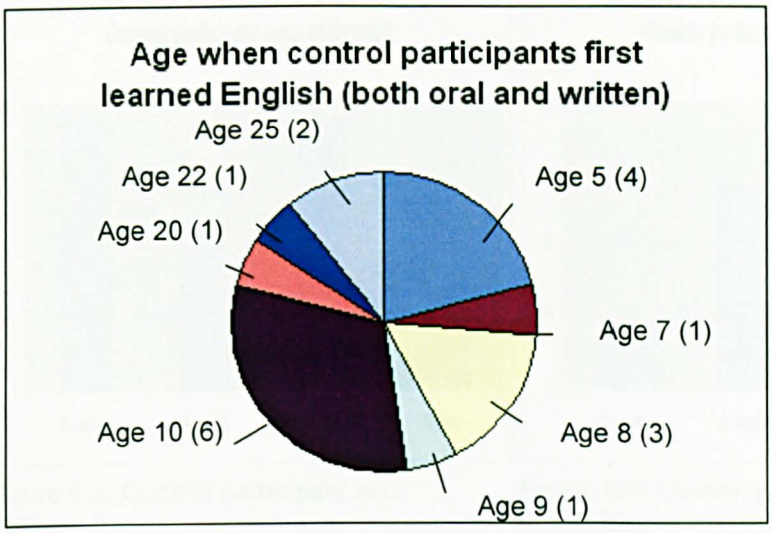


Figure 6.4: Age when control participants first learned English (both oral and written).

6.6.4 Language use of control participants

Participant uses of Bengali and English sharply contrast. Bengali was the language spoken at home for all participants (Figure 6.5), although three participants also sometimes used English at home (Figure 6.6). Perhaps surprisingly, use of both languages at work was broadly balanced. The fact that 12 participants used Bengali at work appears to indicate that the community may be sufficiently large and autonomous to employ those with less strong English skills. However, only one participant used solely Bengali at work. The remaining 11 participants who used Bengali at work also used English in the work environment. That is, their working environment was essentially bilingual; language choice depended on situation and interlocutors. Whereas 19 participants spoke Bengali with friends, only 9 needed to use English. This implies that less than half of the group had L1 English-speaking friends. Again, perhaps this indicates a level of autonomy within the community. The high number of "other" uses of English reflects participants' need to speak English in many public places in London (e.g. in shops and on public transport).

The high frequency of use of spoken Bengali reflects it being the language used at home for most participants. The one participant who did not use Bengali everyday had a L1 English-speaking partner; therefore English was the dominant home language. As a result of living in London, most participants had call to use English on a daily basis.

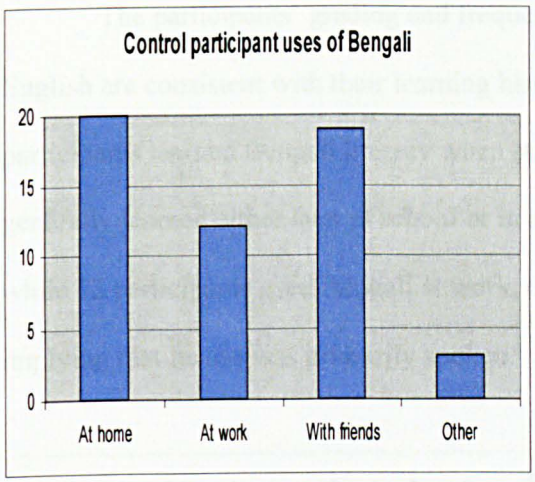


Figure 6.5: Control participant uses of Bengali.

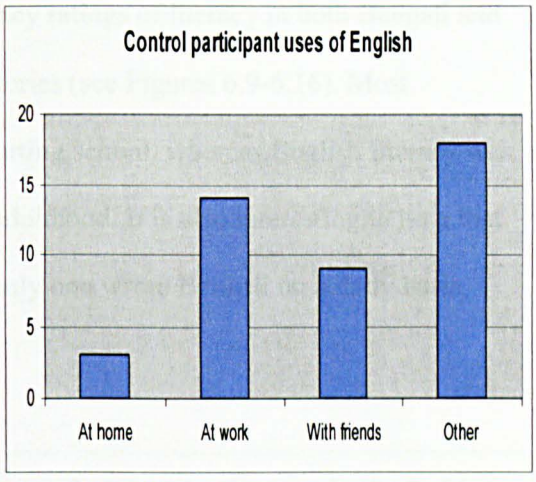


Figure 6.6: Control participant uses of English.

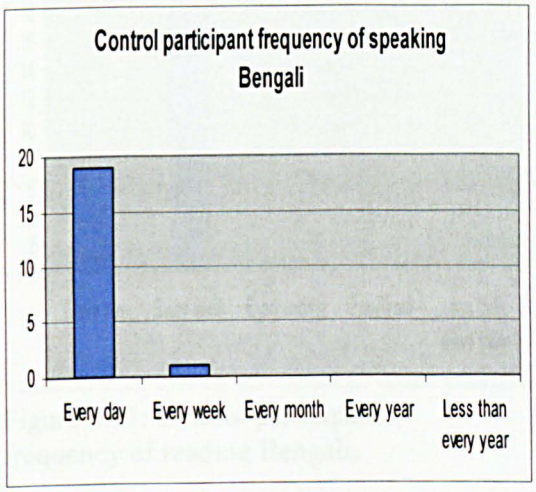


Figure 6.7: Control participant frequency of speaking Bengali.

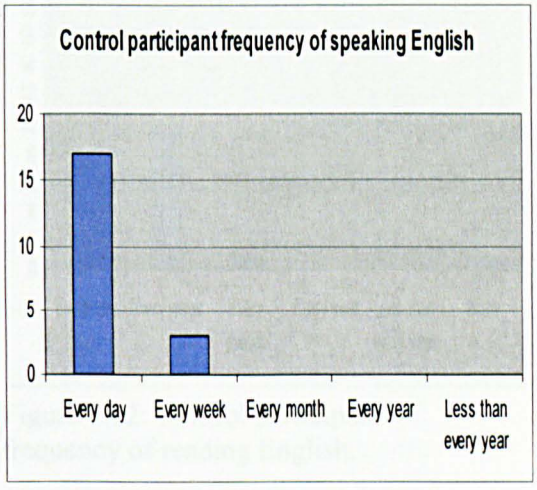


Figure 6.8: Control participant frequency of speaking English.

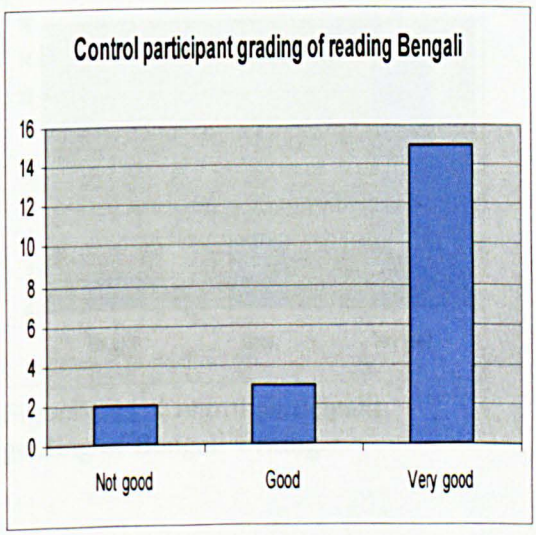


Figure 6.9: Control participant grading of reading Bengali.

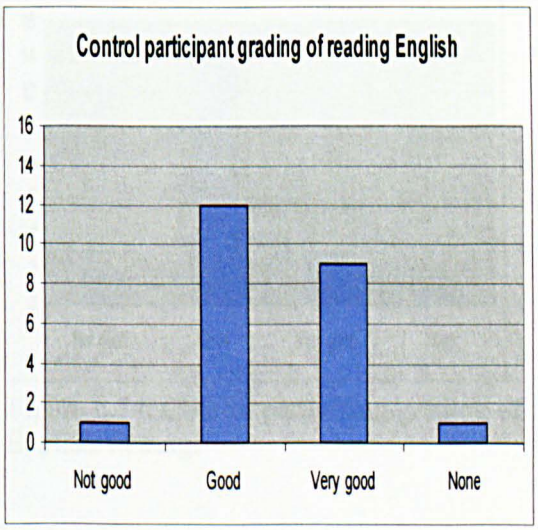


Figure 6.10: Control participant grading of reading English.

The participants' grading and frequency ratings of literacy in both Bengali and English are consistent with their learning histories (see Figures 6.9-6.16). Most participants learned Bengali literacy when starting school, whereas English literacy was generally learned either later at school or in adulthood. It is also interesting to note that while 12 participants used Bengali at work, only one wrote Bengali on a daily basis, implying that its use was primarily spoken.

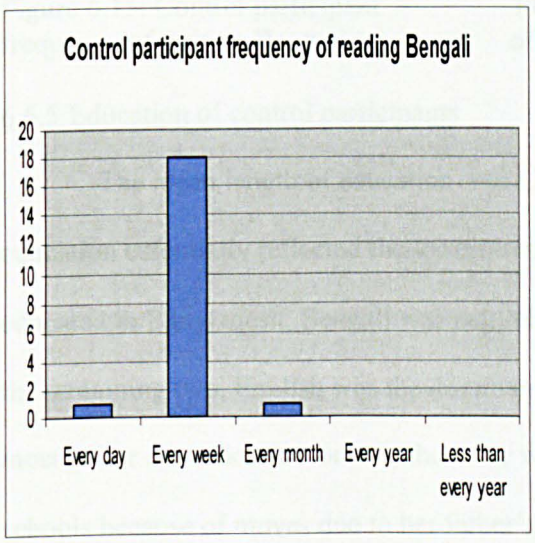


Figure 6.11: Control participant frequency of reading Bengali.

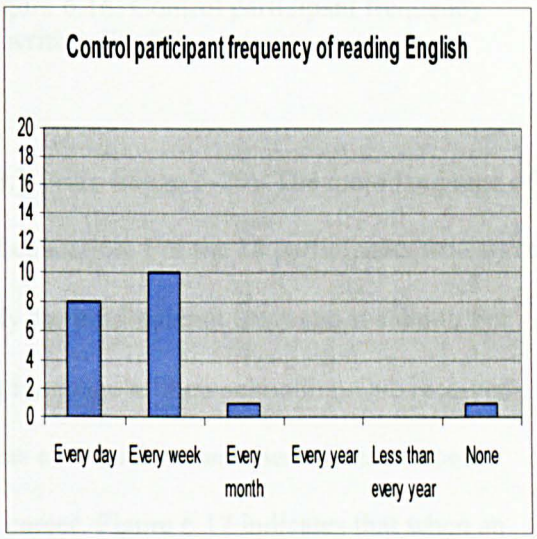


Figure 6.12: Control participant frequency of reading English.

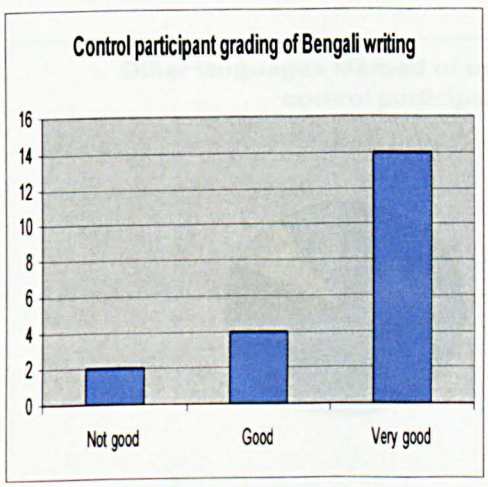


Figure 6.13: Control participant grading of Bengali writing.



Figure 6.14: Control participant grading of English writing.

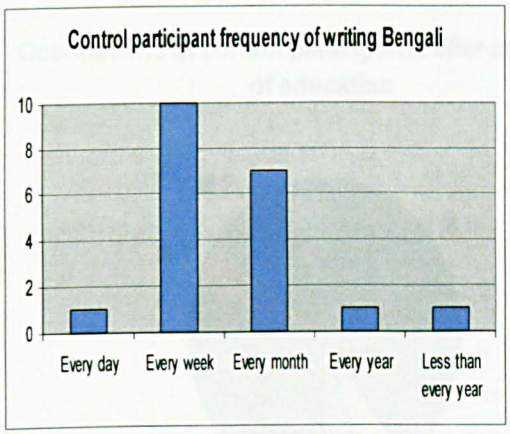


Figure 6.15: Control participant frequency of writing Bengali.



Figure 6.16: Control participant frequency of writing English.

6.6.5 Education of control participants

The mean length of education was 13;3 years (range 5-20). The main language of education essentially reflected the location of education. For the 18 participants who were educated in Bangladesh, Bengali was naturally the predominant language at school. For the remaining two, English was the dominant language of their schooling. One received most of her education in London; the other was educated in a number of international schools because of moves due to her father's career. Figure 6.17 indicates that when an L2 was used or learned at school, that language was English for most participants.

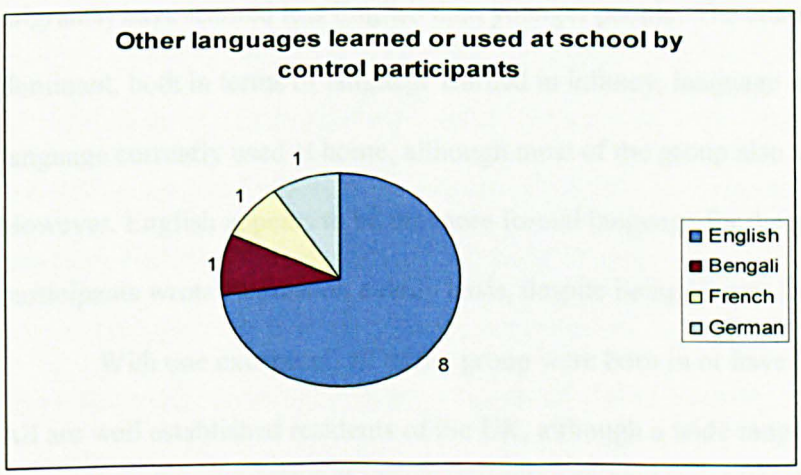


Figure 6.17: Other languages learned or used at school by control participants.

6.6.6 Occupations of control participants

Details of occupations elicited in the questionnaire were categorised following the Standard Occupational Classification advocated by UK National Statistics (2000) and are presented in Figure 6.18. A broad spectrum of professions is represented.

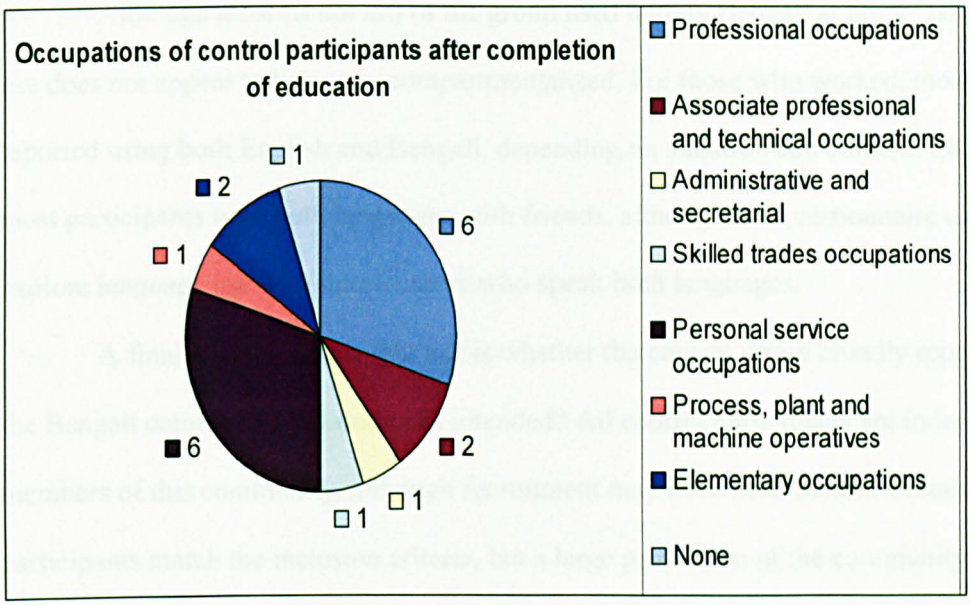


Figure 6.18: Occupations of control participants after completion of education.

6.6.7 Summary of control group characteristics

A group of control participants with a range of L2 abilities, education, occupation, and migratory history was recruited. The group was younger than that initially intended. Indeed, the group could barely be called middle aged, let alone elderly. Identifying older people who were bilingual in Bengali and English was difficult; perhaps this reflects the language use of the community. Elderly people (possibly first generation migrants) have learned less English than younger people. The control group was Bengali dominant, both in terms of language learned in infancy, language of initial literacy, and language currently used at home, although most of the group also used English everyday. However, English appears to be the more formal language for the group. Most participants wrote English on a daily basis, despite being literate first in Bengali.

With one exception, all of the group were born in or have lived in Bangladesh. All are well established residents of the UK, although a wide range of English acquisition histories and abilities is included. Most members of the group were multilingual rather than strictly bilingual. One might suggest that a strictly bilingual person might not be directly comparable to a multilingual language user. However, the sample was believed to be representative of the population of interest. This was confirmed by the fact that the aphasic participants, when recruited, were also multilingual.

Although most (if not all) of the group used mainly Bengali at home, language use does not appear to be neatly compartmentalised. For those who worked, most reported using both English and Bengali, depending on situation and context. Likewise, most participants used both languages with friends, although the questionnaire did not explore language use with interlocutors who speak both languages.

A final question one might ask is whether the control group broadly represented the Bengali community in London as intended? All control participants are indeed members of this community, although recruitment may have been biased. Certainly, all participants match the inclusion criteria, but a large proportion of the community may have been inaccessible. A significant sector of the UK Bengali community is economically inactive. This group may be difficult to access, particularly for university-based researchers. The questionnaire does not directly provide data regarding current employment status, but data from the language use section show that most participants are working, which sharply contrasts with the National Statistics (2000) data of 30% of males and 70% of females being economically inactive.

6.7 Development of assessment materials

No formal aphasia tests (that the researcher is aware of) exist for speakers of Bengali. Administering an aphasia test developed for English speakers in Bengali would be likely to be unreliable and both linguistically and culturally inappropriate. It was therefore considered necessary to develop culturally relevant assessment materials that would be suitable for testing both English and Bengali. These assessments would test the production and comprehension of spoken and written nouns. It was anticipated that participants (and the wider Bengali community) would have various acquisition histories; therefore it was also assumed that their L1 knowledge would be likely to include a distribution of variations on the continuum between Sylheti and Bengali. Words that were *not* cognates in Sylheti and Bengali were therefore not included as potential test items. This proviso also meant that the project would result in the development of aphasia tests that would be more widely useable than a test of one regional variation of Bengali. It was

also considered advantageous to be able to use the same pictures for assessing both Bengali and English. This allows comparison of similar concepts in both languages. Words that were cognates in Bengali and English were therefore excluded. In order to do this, it was necessary to ensure that targets were of broadly equivalent difficulty in both languages. In previous studies of bilingual word finding (e.g. Edmonds & Kiran, 2006), word frequency has been used as a determiner of difficulty, although the comparability of word frequencies in the languages of bilingual speakers is currently unclear. However, in the absence of word frequency values for Bengali it was necessary to take alternative measures.

6.7.1 Selection of test targets

Potential targets were identified on the Kučera & Francis (1967) database of English word frequencies. It was considered necessary to ensure that targets in the tests were not all high frequency words and therefore potentially easy to name. An aphasia test where both aphasic and control participants perform close to ceiling is of little use. Consequently, two groups of imageable nouns totalling around 400 words were chosen from the database – one with a frequency value between zero and 15, the other with values over 50. This distinction between groups of words of low and high frequency (in English) was the initial step of ensuring a range of difficulty in the tests. Black and white line drawings were found for each target. Many of these drawings were obtained from the Snodgrass & Vanderwart (1980) set and the PALPA (Kay *et al.*, 1992), but other drawings were taken from the internet and a file of drawings held within the Department of Language and Communication Science at City University. At this stage, the Bengali equivalents were unknown, but it was necessary to start with a group of nouns that could *potentially* be included in the tests. This initial process was undertaken with the intention of presenting the project consultant with a range of words and pictures that might be included. At this stage, words that were clearly culturally irrelevant were eliminated by the researcher by drawing on knowledge gained by reading about Bengali culture. For example, Bangladesh is predominantly Muslim; therefore targets such as 'church' and

'cross' were rejected, not so much for fear of insult, more for being culturally irrelevant. It is also unlikely that such targets would have comparable frequency values across the two languages and cultures. Likewise, targets such as 'coffee' (very high frequency on the Kuĉera & Francis (1967) database, but rarely drunk in Bangladesh) were also rejected. High frequency words that were homophones for both nouns and other word classes in English (e.g. 'saw' and 'well') were not considered for inclusion.

6.7.2 Screening by project consultant

The project consultant did not express any objection to the prospect of testing Bengali people's single word noun knowledge by pointing to and naming line drawings. The 400 nouns identified by the researcher as potential targets were then passed to the consultant for cultural and linguistic screening. A large number of potential targets were eliminated for various reasons:

- Targets were cognates in Bengali and English.
- Targets were not cognates in Bengali and Sylheti. Although it was anticipated that most aphasic participants would be Sylheti speakers, the exclusion of speakers of Standard Bengali was not intended. Therefore, tests had to be suitable to be carried out with speakers of both variations. When adapting the Aphasia Screening Test (Whurr, 1974) for Punjabi speakers, Mumby (1988) acknowledged the need to make similar compromises.
- Targets were not common in Bangladesh, therefore not widely known and likely to be a cognate with English.

6.7.3 Collection of word latency data

At this stage in the development process, a body of nouns and accompanying pictures had been collected that would be suitable for tests to be carried out in Bengali and English. The initial 400 words had now been reduced to 150, consisting of two groups of 75 in high and low frequency groups. Although the consultant had rejected words that were mismatched across the two cultures, it was still necessary to collect data

which indicated which targets were well-matched in difficulty in Bengali and English. Without these data, it would be difficult to evaluate an unbalanced performance on the test. This might point to a differential impairment or poor matching of the test items (i.e. some targets might be more difficult in one language than the other). Measuring response latencies for the control participants allowed a robust matching of word-pairs across the two languages. If the mean latencies for naming the same picture in Bengali and English were significantly different, this would indicate a poorly matched word-pair that would not be suitable to include in the aphasia tests. The project consultant did not foresee any objections to this proposal. She suggested that many older Bengali people might be unfamiliar with computers, but provided all they had to do was name the picture (while the researcher was responsible for setting up and administering the program), she anticipated no problems.

This latency collection was carried out using SoundBytes, a program developed by Michael Coleman at University College London, and used with his permission. This program allows an image to be presented on a monitor and records a participant's spoken naming response to that image via a microphone. Latency for that response can then be calculated via a spectrogram. The group of potential test targets were scanned (when necessary) and downloaded onto a laptop. A clip-on microphone (Sony ECM-T6) was attached to each participant's clothing during recording. To function, the program needed access to a text file that indicated a running order and which pictures to image. In order to avoid practice or memory effects, the full list of targets was randomised four times. That is, the 150 targets to be named were organised into four lists consisting of all the words, i.e. four different running orders. At this point, the program was piloted with members of the coworker team to establish that the set-up was as required and to practise calculating latencies.

All latency collection sessions were carried out in a quiet environment, although the locations of each session were chosen by the participants for their convenience. Locations included:

- Participant's home
- Participant's place of work
- City University
- The Royal London Hospital
- Local community associations
- Local community centres

Each collection session followed the same protocol:

1. After setting up the computer, the tester briefly explained the test and why it was being carried out. The participant was offered the opportunity to ask any questions.

2. Participants were reminded that they had the right to end the session at any time if they wished. As naming 150 pictures could be tiring, they were also offered the opportunity to request a brief break.

3. Participants were then asked to clip the microphone on to part of their upper clothing. Where this proved difficult, permission was requested to help before assisting.

4. Three practice items were then presented to clarify the test format and expectations. Participants were asked to name the pictures as quickly as possible.

5. Presentations of the 150 test pictures followed. Each picture was presented on-screen for ten seconds. During this time, the program automatically recorded any response. After the ten seconds, the picture disappeared and recording ceased. If the participant made a response after the ten second cut-off point, this response was discarded as it would not have been recorded. The next picture did not appear until the tester had clicked on the mouse.

6. Upon completion of the test, the participant was thanked and appointments for future meetings were made as appropriate.

Ten control participants named the 150 pictures in Bengali first and English second using the first and second running orders. The remaining ten participants named the pictures in English first and Bengali second using the third and fourth running lists. Therefore, no participants named the pictures in the same running order for both

languages, and were therefore unable to anticipate the ordering of pictures, even after previously completing the test in their other language. A minimum of seven days passed between latency collections in the two languages. The researcher was present at all data collection sessions. When English was the target language, he also administered the test. A bilingual coworker administered all testing in Bengali. All participants were asked if they preferred a male or female coworker, and these preferences acted upon where possible. When English was the target language of the session, all instructions and clarification were also spoken in English. When testing Bengali, instructions were in Bengali. These sessions were therefore led by the bilingual coworkers. On these occasions, the researcher acted as an observer after setting up the program. In addition to the computer-recorded data, all responses were recorded on a marking sheet by the tester (i.e. the researcher or coworker as appropriate) (see Appendices 6 and 7). When the anticipated response was elicited, a tick was simply placed by the target word. On all other occasions (production of synonyms, acceptable responses and incorrect responses), the participant's response was recorded on the marking sheet. On occasions when a picture elicited no response, a horizontal line was drawn in the space allocated for the response to that picture.

6.7.4 Analysing the data

Upon completion of the data collection with all 20 control participants, 150 responses in both Bengali and English for each participant had been recorded. Collated naming data are presented in Appendix 8. Latencies were only calculated for correct responses. These responses included either the anticipated response or acceptable synonyms. Descriptions were marked as unacceptable.

Acceptable English responses were judged mostly by the researcher, but also by the project supervisor when in doubt. Judgements of Bengali responses synonyms were carried out initially by the bilingual coworker who collected the response, but other coworkers were included when the original coworker was uncertain. Latency for the onset of each acceptable response was calculated from the spectrogram generated by

SoundBytes. The latency was calculated from the onset of the target word. Any other recorded response (be it verbal or non-verbal) was ignored.

The next stage of analysis was to eliminate targets with insufficient acceptable responses in both languages across the group, i.e. a picture that resulted in well-matched latencies across the two languages would not have been useful if only 25% of the control group successfully named it. A threshold of 70% was set to eliminate targets with poor name agreement. This in effect meant that targets that did not elicit at least 14/20 acceptable latencies were discarded. After calculating name agreement, 35 of the initial 75 targets remained in the high frequency group, while 34 remained from the low frequency set. Emphasis must be placed here on the need for paired latencies. It was important that the test items were of equal difficulty in both languages. To ensure this, the next stage of the development process involved the discarding of any remaining targets that achieved less than 65% pair-matched response. That is, at least 13 participants named the retained words correctly in both languages. Fortunately (as potential targets for the aphasia tests were by now already limited in number), this stage resulted in the removal of only one more target.

The final stage of this vetting process involved carrying out related two sample t-tests on the remaining pair-matched latencies for each word. Where the result of the t-test indicated no significant difference between the Bengali and English latencies, that target was considered acceptable for inclusion in the aphasia tests. Following these calculations, 29 high frequency and 32 low frequency nouns remained eligible for inclusion. At this stage one further target from the high frequency group had to be discarded due to an error. This left a total of 60 targets deemed suitable for inclusion in the aphasia tests. This was considered an acceptable number, and even though an even balance of high and low frequency nouns would have been preferred, the balance of 28 high frequency and 32 low frequency nouns was considered a minor discrepancy. Latency and t-test data can be found in Appendix 9.

6.8 Construction of aphasia tests

The latency data collection resulted in a body of targets suitable for inclusion in the aphasia tests. Items where the mean latencies for each language were significantly different were discarded. The remaining targets included some items where the mean latencies were closely matched between the two languages, as well as items that were less closely matched (but not significantly different). The targets from both the high and low frequency groups were rank ordered by differences between the mean latencies in Bengali and English for each target. The word with the smallest difference between means was ranked 1, the largest difference 28 and 32 for the high and low frequency groups respectively. Those with an odd number ranking were used as comprehension test targets; those with an even ranking as naming targets. This in effect meant that tests of comprehension and naming included 14 high frequency words and 16 from the low frequency group. This enabled, as far as was possible, a balance of low and high frequency targets to be included in tests for both modalities. Likewise, this process also reduced the risk of priming effects in the tests. That is, if a picture and target word were presented as a target of a word to picture matching test, this might have acted as a prime for production of the same target if it was also included in naming tests.

Having established which targets were to be included in which tests, completion of the test development process was straightforward. The aim of this process was not to devise new test designs, rather to establish targets that could reliably be used in tests for Bengali-English bilinguals, similar to those used for unilingual English speakers. Tests for this project were therefore formatted to closely resemble equivalent tests from the PALPA (Kay *et al.*, 1992), a test battery that is widely used in SLT clinics across the UK. The goal of this phase was to complete an assessment of single noun skills in both spoken and written comprehension and naming. Therefore, tests developed included:

- Oral naming test
- Written naming test
- Word repetition test

- Spoken word to picture matching test
- Written word to picture matching test
- Test of reading aloud

Tests demanding an element of participant expression were constructed using the targets set aside for naming. Tests of spoken and written word to picture matching used targets allocated to the comprehension group. There was one exception: The test of reading aloud, although including an element of spoken expression, also utilised targets from the comprehension group. This enabled comparison of the same targets used in tests assessing reading skills. It also allowed a balance of target usage – each target was included in three tests. Each test contained 30 test items. All tests, stimuli and marking sheets can be found in Appendices 10 to 27.

6.8.1 Oral naming test

The list of targets was randomly ordered twice to give different running orders for testing Bengali and English. Two sets of test pictures, reflecting the two running orders, were formatted using Microsoft Word and printed on A4 size paper, including four pictures per page. Two practice items were also included at the beginning of the test to facilitate explanation before beginning the test proper. These targets were taken from the group that had been discarded in the final stage of the development process, i.e. they were words with high name agreement in the control group, but mean latencies were significantly different. Practice items were marked with letters in the test stimuli; test items were given a reference number that reflected the test running order. Marking sheets, closely resembling those from equivalent tests from the PALPA battery (Kay *et al.*, 1992), were also constructed using Microsoft Excel. These were developed for each language, reflecting the different running order for each administration of the test. They included cells for recording participant name, date of assessment and total correct, and also included columns allowing space for the following:

1. The expected response in the target language.

2. Space for recording the participant response. It was anticipated that when the participant response matched the anticipated response identically, a tick would be placed here. All other responses were recorded by the tester.

3. As the assessment phase of the project also included an exploration of cueing effects, space was allocated to give details of appropriate cues to be used and also to allowing a record to be made when that cue had been provided. As the spoken naming test would be administered twice in each language to allow exploration of two different cueing conditions, two marking sheets for each language were developed. One included the semantic cues that were used, while the other included cross-linguistic cues. All naming test marking sheets included phonemic cues, reflecting their presence in both conditions in both languages. These were provided if a semantic or cross-linguistic cue failed to facilitate production of the target (the methodology for this exploration of cueing is explained in Section 7.7).

Brief instructions for aphasic participants were composed in English and translated to Bengali by members of the coworker team. This ensured that the instructions were consistent, across languages assessed and across various testers. This method of producing participant instructions applies to all tests developed in this project.

6.8.2 Written naming test

Construction of the written naming tests for Bengali and English largely mirrors the methodology followed in the oral naming test construction. Test targets were identical to the oral naming test, but presented in another randomised running order for each language. The written test marking sheets naturally reflected this order. Marking sheets indicated the anticipated written response and allocated space for the tester both to record the response and to indicate when a graphemic cue had been given. The English written naming test marking sheet listed the anticipated responses in English script only. In the Bengali test, anticipated targets were included both in Bengali script and in alliterated English script. This was to assist the researcher's organisation of responses rather than for

the coworkers, who were all literate in Bengali. Participants' written responses were retained.

6.8.3 Word repetition test

No picture stimuli were used in this test. The tester had to orally present a list of words (individually) and ask the participant to repeat them. Again, a randomised running order was used for each language. Marking sheets followed the basic layout explained above. Incorrect responses were recorded by the tester. The initial intention was to record responses on a minidisk recorder, but as most participants did not consent to this, this plan was abandoned.

6.8.4 Spoken word to picture matching test

In this test, the participant was presented with a spoken noun read by the tester and had to point to the correct picture from a choice of five. Picture materials were arranged using one test item per A4 page. Each page included the correct target and four distracters. Distracters were line drawings similar in style to the target and drawn from the same sources. Mirroring the PALPA (Kay *et al.*, 1992) equivalent, each test item included:

1. Close semantic distracter: This was closely connected in meaning to the target item (e.g. target 'leaf', distracter 'flower').
2. Distant semantic distracter: This was also related in meaning to the target, but less closely (e.g. target 'leaf', distracter 'nut').
3. Visually related distracter: Visually similar to the target, but semantically unrelated (e.g. target 'leaf', distracter 'feather').
4. Unrelated distracter: In addition to having no obvious semantic connection to the target, unrelated distracters were also semantically related to the visual distracters (e.g. target 'leaf', visually related distracter 'feather', unrelated distracter 'bird').

It was not possible to match the distracter items on linguistic variables because of the lack of information for Bengali. The consultant and the coworker team vetted

potential distracters for their cultural suitability. Following the format of the other tests, two practice items were used as a demonstration before administering the test proper. The marking sheet included the target and all distracter items for each test item. The participant's response was recorded simply by placing a tick beside whichever picture was pointed to. No feedback on performance was given.

6.8.5 Written word to picture matching test

Materials for this test largely mirrored the spoken word to picture matching test; distracters were identical to those used in the spoken word to picture matching tests. Running orders were again randomised for each language and the marking sheets reflected this. For this test, participants had to read the target item from a flashcard written in the test language and point to the appropriate picture. Participants were not allowed to say the word aloud before pointing to a picture. This instruction was clarified during the practice items. Flashcards were A5 size and each included one word per card written in typed script approximately 3-4cms high. Flashcards were produced by the researcher for both the Bengali and English versions of the test. Bengali words were corrected and confirmed by members of the coworker team.

6.8.6 Test of reading aloud

Reading aloud of target items was tested after written word to picture matching. Participants had to first read the word silently and point to the matching picture. They were then asked to read the word aloud. Their responses were recorded as previously described, i.e. incorrect responses were recorded by the tester on the appropriate marking sheet.

6.9 Completion of control data collection

For the final stage of test development, it was necessary to revisit a portion of the participants without brain injury to complete collection of control data for the aphasia tests. As all control participants had already named the naming test stimuli in the latency collection process, these data were used as the control data for the oral naming tests.

Control data for the spoken word to picture matching tests were collected for both Bengali and English. Performance was expected to be at or close to ceiling, as the targets included in the test were those that had been most reliably named by the same control group. Data for the spoken word to picture matching tests were collected from 15 of the original 20 participants. Control data for both tests are presented below in Table 6.1.

Test	Language	Mean correct	Standard Deviation
Spoken word to picture matching	Bengali	29.87	0.35
	English	29.67	0.62
Oral naming	Bengali	27.70	1.75
	English	27.45	2.21

Table 6.1: Control data for spoken word to picture matching and oral naming tests for both Bengali and English.

The main focus of this project was an exploration of spoken word finding. Consequently, control data were acquired for tests of spoken noun comprehension and expression. With hindsight, given that aphasic participants would also be tested on written naming where appropriate, it would have been useful to collect control data for written naming. This was an oversight by the researcher, and is unfortunate, as one might anticipate that written expression is the modality where people without brain injury would be most likely to make an error. It was assumed that performance of the reading aloud and word repetition tests would be at ceiling.

6.10 Review and summary

The process of developing aphasia tests suitable for use in Bengali and English has been described. This has included the steps taken to recruit a project consultant, control participants and coworker team. Following completion of this stage, six single-word tests were ready for use with the aphasic people participating in the project. Before describing the bilingual assessments with people with aphasia in the next chapter, it is appropriate to discuss some areas of the test development process that did not work out as planned.

6.10.1 Consultant idiolect

The project consultant played a vital role in the early vetting of potential test targets and pictures. However, with the hindsight of working with a number of Bengali people, her knowledge of Bengali reflected her idiolect. In effect, her acquisition of Bengali was limited to her experience. This is entirely reasonable, of course, but as a continuum between Sylheti and Bengali exists, not all her judgements of cognate status were consistent with members of the coworker team and the control participants. It would have been very difficult to progress the project without that early assistance, but some test items that had been judged as cognates in Sylheti and SCB by the consultant were later discovered to have alternative regional variations. As the number of possible words suitable for inclusion in the project was limited, some targets had to be retained that were not cognates in Sylheti and SCB. On an individual level, this is not problematic, but it is a modification from the original criterion for inclusion of test targets.

6.10.2 Gender balance of coworker team

When recruiting the coworker team, a balance of gender was sought, as it was expected that some Bengali female participants (both control and aphasic) would prefer a female coworker. The coworker team initially included three males and two females – the five highest ranked candidates after the interview process. One of the female coworkers was in fact a SLT student in the department, and although she was a L1 Bengali speaker, she spoke the Calcutta variation of Bengali and was unable to communicate effectively with participants in Sylheti. Although the targets included in the tests were cognates in Sylheti and SCB, this coworker's participation was unsuccessful. Participants were able to understand her (as a result of learning the standard form at school), but she found their regional variation very difficult. As the coworkers were intended to be seen as allies and facilitators of communication, it did not prove feasible to continue using this coworker in the project despite her status as an SLT student and her enthusiasm to be involved. Unfortunately, this left only one female coworker on the team.

6.10.3 Difficulties of recruiting control participants

Despite the large Bengali population in London, recruiting a group of 20 suitable people to participate in the control group was both difficult and time-consuming. Difficulties were encountered for a number of different reasons:

- Control participants were sought in the weeks preceding Ramadan. A number of potential participants were interested in the project, but preferred to postpone participation until Ramadan had passed. These wishes were respected, but when potential participants were contacted again after Ramadan, many chose not to participate.
- Some potential participants expected to be acknowledged as co-authors of the project. It is possible that these people misunderstood what their role would be. Perhaps they thought that being a control participant might result in employment. In fact, their participation remained anonymous. When the reasons for maintaining anonymity were explained, they chose not to participate.
- Some suitable participants wanted to be paid for participating.
- Many enquiries were from people who were too young to participate, who were looking for work experience.
- Research with ethnic minority communities, especially in London, is becoming increasingly common. It might have been the case that some people were reluctant to participate because of previous (unrelated) studies that resulted in negative experiences. Although little or no research has been carried out with Bengali people with aphasia in London, it is also possible that other studies requesting control participants have 'exhausted' people's willingness to participate, especially when no recompense is offered.

6.10.4 Discussion of latency data collection

The process of collecting naming latencies was not at all as anticipated. Latencies were much slower than expected in both languages. Part of this slowness can be attributed to the fact that bilinguals have to maintain access to many more words than unilinguals; therefore the increased use of capacity results in slower processing for tasks associated with lexical retrieval. Gollan *et al.* (2005) have provided evidence to support this: Their bilingual group named items significantly slower than a unilingual group, yet there was no difference in the groups' speed of completing a semantic classification task. Consequently, the researchers attribute the slower mean naming latency for the bilingual group to processes of lexical retrieval. However, the mean latencies collected from the control participants were often remarkably slower than data collected from people from western cultures; therefore it is difficult to solely attribute this slowness to bilingual lexical retrieval mechanisms. Mean noun latencies collected from western subjects are commonly around 600 milliseconds (such as in Barry *et al.*, 1997), yet most mean latencies collected in the current study were between 1000 and 2000 milliseconds, sometimes even slower (see Appendix 9). Why might that have been the case? It can not have been a result of testing in L2, as latencies were just as slow in participants' L1. Consequently, some items have very large latency standard deviations in both languages. There are no obvious linguistic reasons for such a discrepancy; therefore the participants' culture must have had an impact. The project consultant voiced no objections regarding the prospect of testing Bengali people's naming of pictures, yet clearly something is different to western people's performance in a similar situation. Although the researcher is unaware of studies collecting latency data with Bengali speakers, other researchers (e.g. Lahiri & Marslen-Wilson, 1991; Bialystok & Majumder, 1998) have carried out psycholinguistic experiments with this population and not reported any difficulties. However, the faster naming speed from other studies could also reflect the fact that young undergraduate students are often used as participants, whereas this is not the case for the current study.

Name agreement was also poor for many items. The inclusion criterion for name agreement did not appear strict, yet 82 of the 150 items had to be rejected. It was anticipated that many items would be available for inclusion in the aphasia tests, and expected to be able to select the items with the best matched mean latencies for inclusion in the tests proper. In fact, after items with insufficient name agreement and significantly different mean latencies in the two languages had been discarded, so few items remained that all had to be included in the aphasia tests. This meant that items were primarily selected because their mean latencies in Bengali and English showed no significant difference.

In Bethlehem's (2005) case study of a unilingual Bengali speaker with aphasia, she describes that the case had difficulty recognising line drawings of target objects. However, she attributes this difficulty to the fact that he had never been to school and was illiterate. All the participants in the current study were educated and literate in at least one language; therefore this appears unlikely to be relevant here. It is also possible that being physically connected to a computer (i.e. via the clip-on microphone) might have been distracting or distressing, especially for older participants. It was also evident that some participants initially found the task so absurdly obvious that they thought they must have misunderstood the nature of the task. Despite instructions and practice pictures, some people tried to describe the pictures rather than name them and needed clarification to continue the task. However, on these occasions, the tester (i.e. the researcher or a coworker) explained the test again; therefore any misunderstanding should not have had a significant impact on the overall data, even if some individual responses had to be discarded.

It was anticipated that this task would be easy for the control participants, as it had been for the participants in other picture naming studies (Section 2.2). However, as mean latencies were surprisingly slow in both Bengali and English, one might argue that these data represent the performance of the group. The aim was to identify targets that elicited mean latencies that were not significantly different across the two languages.

Even if these latencies were surprisingly slow, the fact that they were cross-linguistically matched enabled their inclusion in the aphasia tests. However, one might also ask what could have been done to overcome this problem. Participants were encouraged to respond as quickly as possible at the start of the test and again during the test if there was a clear misunderstanding between participant and tester. When analysing their latency data, both Barry *et al.* (1997) and Dell'Acqua *et al.* (2000) excluded latencies slower than 3000ms from their analysis on the grounds that a latency slower than this must indicate an occurrence of a word finding difficulty. It would have been possible to set a cut off point in the latency data, but this would have meant discarding more items that failed to satisfy the criteria for name agreement. As so many items were already discarded, one more round of vetting is likely to have eliminated more items than thereby limiting the test items to a small number. Ideally, the data in both languages would have been fast, closely matched with small standard deviations. This is not at all what was actually acquired, but at least the variability was wide in both languages, thus indicating that the stimuli were not biased towards one language.

Considering the effort put into ensuring that the tests included items with a range of difficulty, it is notable that mean latencies in both English (Pearson r = -.182; df = 58; p = .140) and Bengali (Pearson r = -.029; df = 58; p = .815) are uncorrelated to the word frequency values. Mean latencies in both languages are, however, highly correlated with each other (r = .615; df = 58; p<=.001). This indicates that English word frequency values had no impact on naming latencies. Had this been known before collecting the data from the control participants, it would have been possible to exercise more flexibility when identifying potential test items.

7 An assessment of word finding difficulties in bilingual aphasia

7.1 Introduction

This chapter describes the process of carrying out an assessment of word finding with a group of participants with bilingual aphasia. The tasks of identifying and recruiting participants will be described in addition to introducing each participant individually (all participant names used in this study are pseudonyms). The contents of the bilingual test battery and the assessment process will be described. Data will be used to explore the following questions:

- Is there evidence of cross-linguistic differences in word naming and responses to cueing, and if so, do differences follow ratings of pre-morbid ability?
- Do the data indicate at what level of processing (e.g. semantic versus phonological) that word production may be breaking down for each participant?

The process of administering the assessment battery with this population will be evaluated and hypotheses will be raised driven by the assessment data and the models of bilingual language processing discussed in Section 2.6 regarding how each participant might respond to word finding therapy.

7.2 Obtaining ethical approval

Ethical approval for the project was obtained from the North East London Health Authority Research Ethics Committee before the current researcher began work on the project. This was gained in advance to facilitate confirmation of project funding. This approval permitted accessing potential participants from eight NHS Trusts including, crucially, the Trusts covering Tower Hamlets, the borough that is home to most Bengali people living in London, and access to medical notes of patients within these Trusts. Although approval was restricted to NHS patients within the approved area, recruitment of potential participants independently of the NHS was unrestricted.

7.3 Recruitment of aphasic participants

All participants acquired aphasia following a single CVA. The post-onset time had to be at least six months at time of consent. This lowered the likelihood of any

spontaneous recovery confounding possible gains from SLT. Additionally, all aphasic participants had no reported hearing impairment and normal or corrected-to-normal vision. Minimal bilinguals, i.e. those who only knew a few words of their L2 pre-morbidly, were excluded. This was established by completing the language acquisition history questionnaire developed by Paradis & Libben (1987). This includes self-rating of pre-morbid language abilities and was administered by the researcher and completed with the input of both the aphasic participants and their families. Due to the migratory history of the Bengali community, it was anticipated that all participants would be L1 speakers of Bengali with L2 English. However, L1 speakers of English would not have been excluded provided that their pre-morbid Bengali skills were sufficient and they satisfied the inclusion criteria.

As approximately 20% of the SLT caseload at Barts and the London NHS Trust are Bengali speakers (equating to over 200 referrals per year), initial attempts at locating participants included searching current and discharged caseload files within the Trust. The researcher also gave a presentation about the project to the Trust's SLT team with the hope of gaining referrals of potential aphasic participants. Despite initial optimism, positive feedback from the SLTs, and the large numbers of Bengali people on the caseload, potentially suitable participants proved very difficult to locate. Many elderly Bengali people on (or discharged from) the Trust's caseload had very limited English and were therefore unsuitable. Also, a majority (around 80%) of Bengali clients were treated for dysphagia only. Case notes for these clients presented no indication of acquired language disorders. It was initially suspected that this high percentage of dysphagia treatment was a result of the potential difficulties of working with aphasic speakers of languages other than English. However, consultation with the manager of the Barts and the London SLT department revealed that it was broadly representative of unilingual English speakers on the caseload. Contact was maintained with this SLT department throughout the project, but this only resulted in three suitable aphasic people who were

willing to participate. This was a much lower number than anticipated; therefore a number of other sources were explored:

- Bengali Associations across London were contacted with the hope that they might have provided support to or have known of suitable potential participants.
- Relevant local charities such as Age Concern and Connect UK were also contacted, either by letter or a visit by the researcher.
- A short introductory article about the project emphasising the need for aphasic people was published in both English and Bengali local newspapers. It was anticipated that although aphasic people themselves might not have read these newspapers, family members or acquaintances might have been able to act as a facilitating link.
- The researcher attended a chaplaincy meeting at the Royal London Hospital that was attended by local Imams who might have been aware of suitable participants.
- GP surgeries in Tower Hamlets were contacted requesting potentially suitable participants. Although most GPs chose not to reply, some allowed the researcher to search their patient databases (this was permitted by the project's ethical approval) or passed on (with their patients' agreement) details of potential participants.
- Community centres specifically set up for the Bengali community were contacted. When centre managers expressed an interest in the project, the researcher visited the centres to clarify the difficulties of the people sought for the project.
- Requests targeting SLTs with suitable aphasic people on their caseloads were published in both the newsletter of the British Aphasiology Society and the Bulletin of the RCSLT.
- A short article introducing the project and its need for participants was published in Therapy Progress, a publication primarily for professionals working within Barts and the London NHS Trust.
- The researcher gave a presentation at the launch of a project targeting inclusion of aphasic people from ethnic minority communities in the UK initiated by Speakability,

a charity that supports aphasic people across the UK. This presentation also resulted in a short article in Speaking Out, the charity's own magazine.

- Contact was made with the manager of the SLT department in Bradford, home to the largest Bengali community in the UK after London, with the hope that they may have had a caseload of suitable people with bilingual aphasia. The initial response was very positive, and steps were taken to modify the ethical approval to include Bradford as a secondary site. However, despite the initial optimism, this contact led to nothing.
- Stroke and neuroscience medics within Barts and the London NHS Trust were contacted with introductory information regarding the project.
- Contact was also established with South Asian Stroke Support Group, the only stroke support group specifically targeting people from South Asian communities in the UK.

7.4 Aphasic participants

A total of six suitable aphasic participants agreed to take part in the project (one further potential participant preferred not to take part). Initial meetings began with gaining consent from the participants. A family member was always present at this meeting both to facilitate gaining consent and to assist in the collecting of information regarding the participant. A bilingual coworker was also present at the first meeting to assist where appropriate. Wherever possible, the gender of the bilingual coworker was matched to the participant for cultural reasons. Before consenting, all participants and family members were given the opportunity to ask questions about the project; they were also given an information sheet in either English or a version professionally translated into Bengali (or both, where requested) (see Appendices 28 and 29). All participants signed an itemised consent form in either Bengali or English as appropriate (see Appendices 30 and 31). The majority of participants did not consent to either video or audio recording of sessions. As this was the case, responses to test stimuli that would have been recorded (such as the naming test or word repetition task) had to be transcribed. After giving consent, all participants were interviewed using the language

acquisition history questionnaire developed by Paradis & Libben (1987). Each participant's GP was informed of their participation in the project.

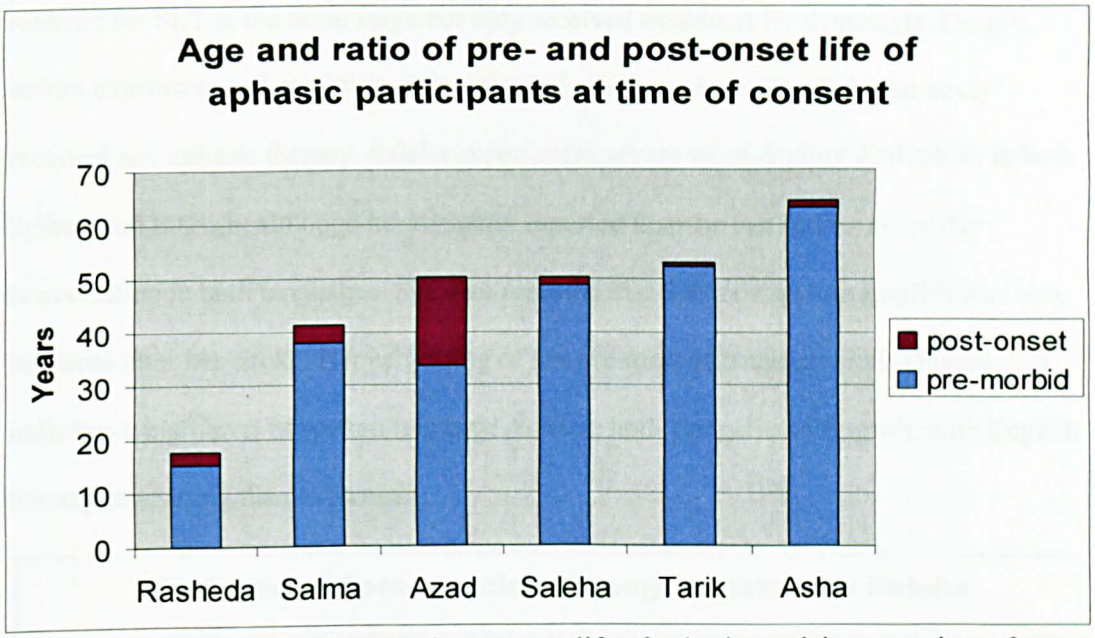


Figure 7.1: Age and ratio of pre- and post-onset life of aphasic participants at time of consent (ordered from youngest to oldest).

Of the six participants, four were female. Figure 7.1 gives the age and post-onset time for each participant. Mean age at point of consent was 46;1 years (range 17;1–64;3 years) and at onset of aphasia was 41;1 years (range 15;4–63;2 years). All were established residents of the UK; mean number of years since immigration was 29;8 years (range 16-39 years). Mean number of years in education was 12;10 years (range 9-17 years). All participants had a Muslim background. The aphasic participants will now be introduced in the order of severity of naming impairment (most severe to least severe impairment).

7.4.1 Saleha

Saleha is a right-handed female, aged 50;3 years at consent. She was born in Sylhet and learned Sylheti as her L1. She learned to speak, read and write Standard Bengali from age 5 at school, which she attended for 10 years. She also learned to speak Hindi, Urdu and Punjabi in Bangladesh, and first learned English on her move to the UK 28 years ago. She is married and has four adult children. Before her stroke, Saleha spoke Sylheti every day at home and with friends; she also read and wrote Bengali weekly. She spoke English every day at home and in the local environment and read English weekly,

although rarely needed to write it. At age 48;9 years, Saleha suffered a left hemisphere CVA (further details were unavailable from her GP) and became aphasic. She was referred for SLT at the acute stage but only received treatment for dysphagia. Despite severe expressive and receptive difficulties in both Bengali and English, she never received any aphasia therapy. Saleha experiences severe word-finding difficulties in both Sylheti and English, although her daughter reported that she can follow every day conversation in both languages. She also reported that Saleha's spoken English was very impaired after her stroke. Her self-rating of her pre-morbid language skills (Figure 7.2) indicates a high level of spoken language skills in both Bengali and English, with English literacy less strong than in Bengali.

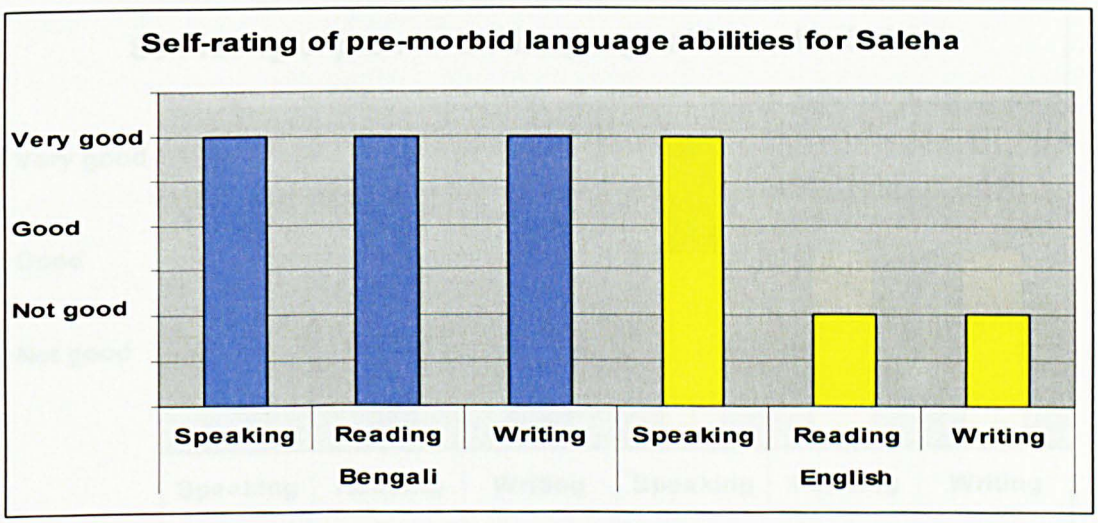


Figure 7.2: Saleha's self-rating of pre-morbid language abilities.

7.4.2 Salma

Salma is a right-handed female, aged 41;2 years at consent. She suffered a cerebral haemorrhage in the left internal capsule and lentiform nucleus at age 37;9 years. Salma is married and has three young children, two of these were under 5 years old at the time of her stroke. Salma was referred to SLT at the acute stage following her CVA, although it did not prove possible to trace details of this treatment. She received no SLT after being discharged as an inpatient. Her husband reported that she sometimes finds speech in both languages difficult to understand and that she is often forgetful. Speech in both Sylheti and English is anomic, characterised by severe word finding difficulties and

false starts.

Salma was born in Sylhet, where Sylheti was the home language. She attended school for 3 years in Bangladesh and learned to read and write Standard Bengali from age 5. Salma and her family moved to the UK when she was 12 years old, where she first learned to speak, read and write English and attended mainstream school in London for a further 5 years. After completing school, Salma worked as a child-carer. Before her stroke, Salma spoke Sylheti everyday at home and with friends and also used English daily at work. She also read and wrote both Bengali and English at least weekly. Salma's self-ratings of her pre-morbid language skills (Figure 7.3) indicate that she had learned English to a broadly competent level.

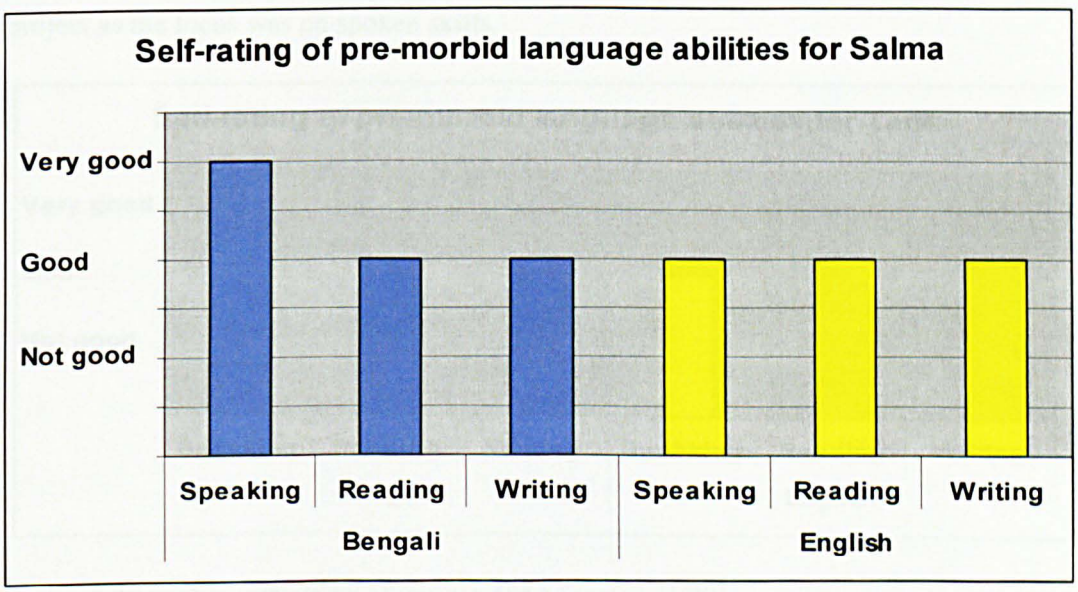


Figure 7.3: Salma's self-rating of pre-morbid language abilities.

7.4.3 Tarik

Tarik is a right-handed male, aged 52;10 years at consent. He was born in Sylhet, learned Sylheti as his home language, and learned spoken and written Standard Bengali from age 5 at school, which he attended for 12 years. After completing his education, Tarik first worked as a cotton mill worker in Sylhet. He moved to London at age 16 years, and learned to speak English, but never became literate. His main employment was in the restaurant trade in East London. Before his stroke, Tarik spoke Sylheti every day at home, at work, and with friends. He read Bengali at least every month, although he rarely

needed to write it. He also spoke English everyday at work and around his local environment. At age 52;3 years, he suffered a cerebral haemorrhage in the left hemisphere thalamic area and was referred to SLT. Assessment established mild comprehension problems in Sylheti, more severe in English. Speech in both languages was also impaired, characterised by reduced fluency, phonological errors and word finding difficulties. Tarik had the shortest post-onset time (7 months) of all the participants. This is enough to meet the minimum post-onset time criterion set out above, but of all the participants, his language disability was likely to be the least stable. Tarik's self-rating of his pre-morbid language skills (Figure 7.4) indicates a good level of spoken English, and although he was never literate in English, this did not exclude him from the project as the focus was on spoken skills.

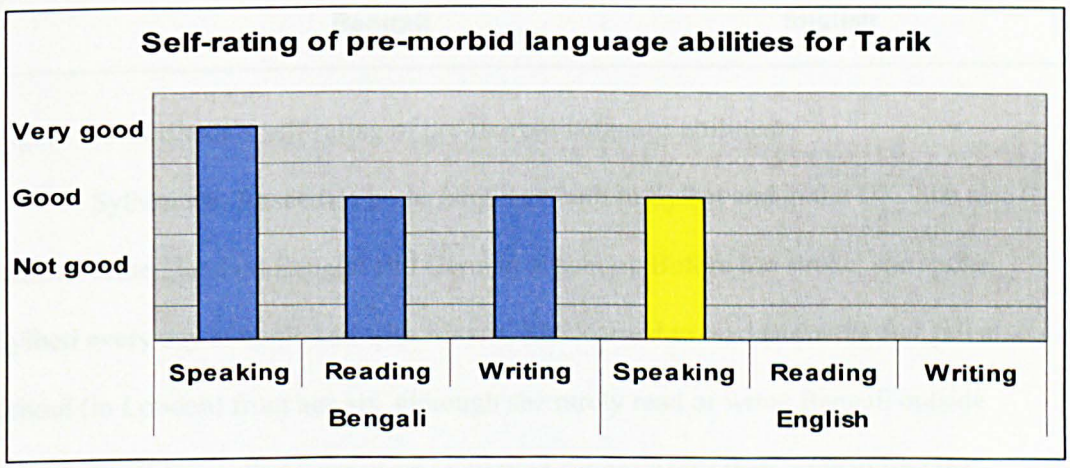


Figure 7.4: Tarik's self-rating of pre-morbid language abilities.

7.4.4 Rasheda

Rasheda is a right-handed female, aged 17;1 years at consent. She suffered a left hemisphere intra-ventricle subarachnoid haemorrhage at age 15;4 years. Until onset of aphasia, her school had had no concerns regarding her speech and language development. Following her CVA, Rasheda was referred to SLT by her school, who were concerned about her being quiet. SLT assessment in English carried out within the NHS in 2004 indicated high level comprehension difficulties, although Rasheda often masked these difficulties in conversation. Spoken output was fluent but characterised by word finding difficulties. After her CVA, Rasheda was able to return to school and complete her

GCSEs and hoped to go on to study computing at a local college. Her Bengali skills were not assessed by SLT, but her mother expressed no immediate concerns. Rasheda was born in Sylhet, but moved to the UK before school age and was educated there.

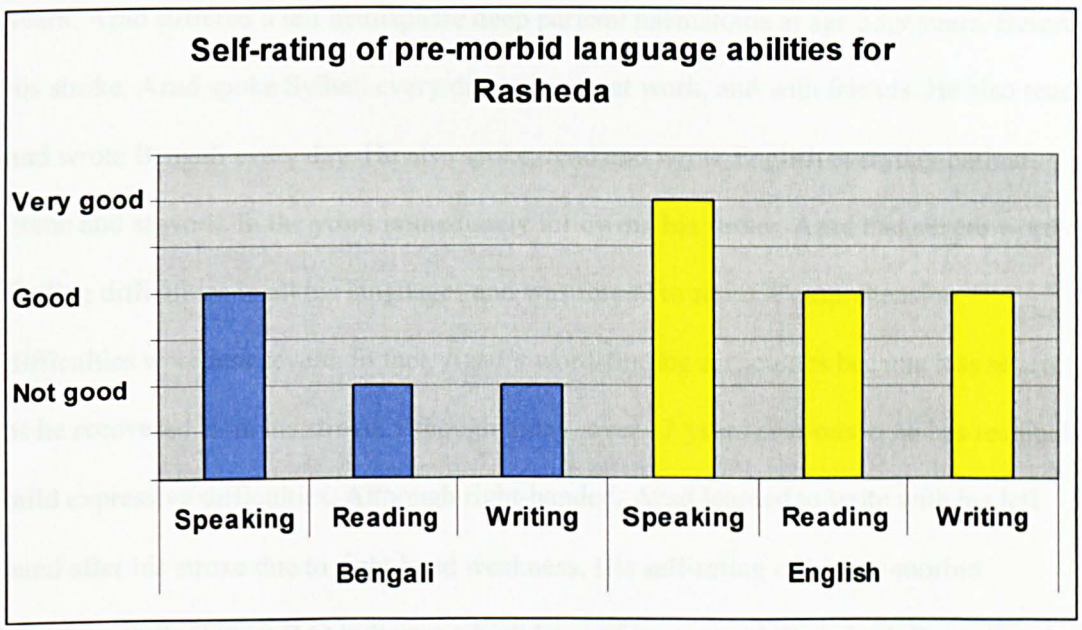


Figure 7.5: Rasheda's self-rating of pre-morbid language abilities.

Sylheti was Rasheda's home language both in Sylhet and in the UK. She also learned some Standard Bengali and German at school. Before her stroke, she spoke Sylheti every day at home and with friends. She learned to read and write Bengali at school (in London) from age six, although she rarely read or wrote Bengali outside school. English was first learned when starting school. Until then, Sylheti was the dominant language in her environment. Before her CVA, Rasheda spoke English every day with friends and at school. She learned to read and write English at about age five and continued to read and write English on an everyday basis. Rasheda's self-rating of her language skills (Figure 7.5) indicates English dominance, even though Sylheti continues to be the dominant language of her home environment.

7.4.5 Azad

Azad is a male, aged 50;2 years at consent. He was born in Sylhet and learned Sylheti as his L1. Most of his 17 years of education were delivered in Standard Bengali; he also had some English lessons from age 10 and had some lectures in English while attending university. He also learned good spoken and written Arabic. After moving to

London in 1974, Azad had successful careers as a mechanical engineer and later as an interpreter in the UK Home Office. Azad has an adult family who have left home. Over the course of this project, he was proud to become a father again – his first son in 20 years. Azad suffered a left hemisphere deep parietal haematoma at age 33;9 years. Before his stroke, Azad spoke Sylheti every day at home, at work, and with friends. He also read and wrote Bengali every day. He also spoke, read and wrote English everyday both at home and at work. In the years immediately following his stroke, Azad had severe word-finding difficulties in all his languages and was forced to retire. Comprehension difficulties were less severe. In fact, Azad's word-finding difficulties became less severe as he recovered from his stroke, although today, over 17 years post-onset, he has residual mild expressive difficulties. Although right-handed, Azad learned to write with his left hand after his stroke due to right hand weakness. His self-rating of his pre-morbid language skills (Figure 7.6) indicates a high level of language skills in both Bengali and English.

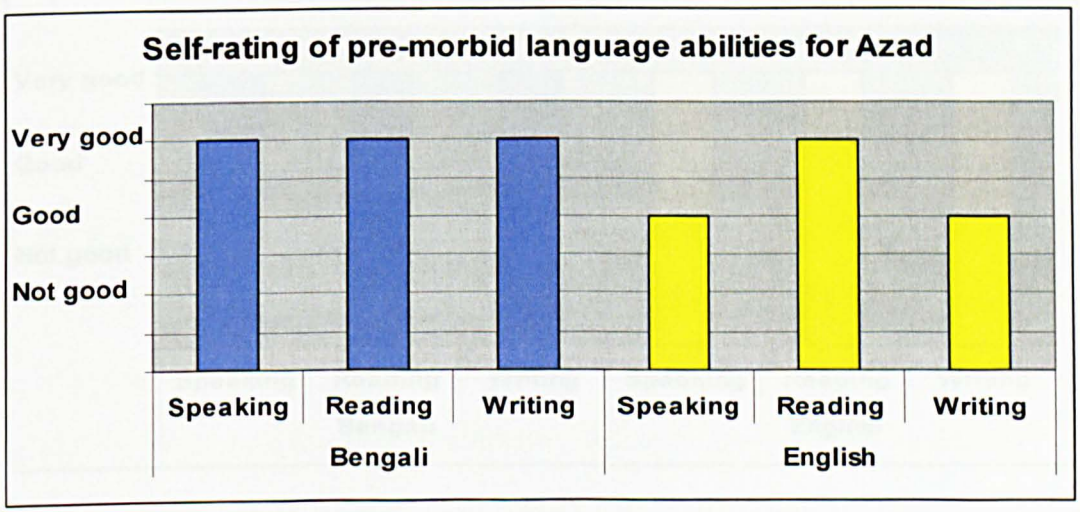


Figure 7.6: Azad's self-rating of pre-morbid language abilities.

7.4.6 Asha

Asha is a female, aged 64;3 years at consent. Although she was taught to write with her right hand at school, she prefers her left hand for all other activities. Asha was born in Dhaka and learned Standard Bengali as her L1, which was also the main language at school, and which she learned to read and write from age 5 years. She also learned

some spoken Hindi and Urdu and had some lessons in English from age 8 years. Unusually, she also learned some Sylheti as an additional language, as her family moved to Sylhet for a short time in her childhood. After completing 17 years of education including university, Asha qualified and worked as a teacher, both in Bangladesh and in the UK, after moving here 39 years ago. Before her stroke, Asha spoke, read and wrote Bengali every day at home, at work and with friends. She also spoke, read and wrote English every day at work, with friends and in public places. At age 63;2 years, Asha suffered a right hemisphere CVA resulting from complications of a carotid endarterectomy. This resulted in mild expressive aphasia in both Bengali and English characterised by word-finding difficulties, hesitations and circumlocutions. Asha was referred for SLT and received therapy targeting word finding difficulties and confidence building. Asha's self-rating of her pre-morbid language skills (Figure 7.7) indicates an all-round high level of knowledge in both languages.

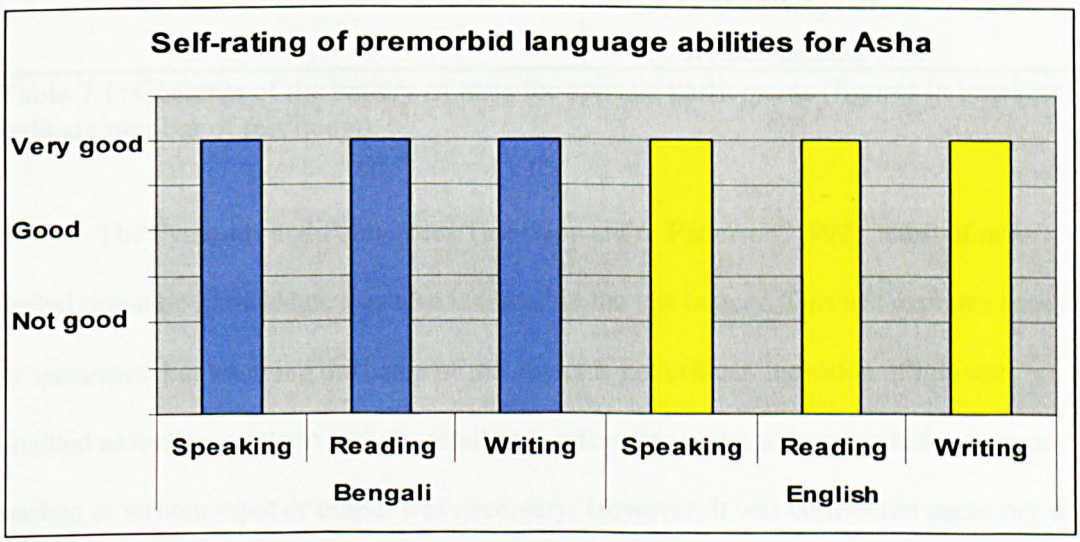


Figure 7.7: Asha's self-rating of pre-morbid language abilities.

7.5 Collation of test battery

The process of constructing six tests for aphasia at the single noun level was described in the preceding chapter. All these tests were included in the battery to be used in the assessment of word finding difficulties with the aphasic participants. Additionally, as the tests developed for this project mirror the format of the equivalent tests from the PALPA (Kay *et al.*, 1992), the original PALPA tests were also included, although these

were only administered for English. This allowed comparison of aphasic participants' performance on the English versions of the original PALPA tests and the novel tests from the project. Table 7.1 summarises the contents of the test battery.

Bengali	**English**
Novel tests: Spoken word to picture matching (30) Written word to picture matching (30) Reading aloud (30) Word repetition (30) Oral naming: cueing condition 1 (30) Oral naming: cueing condition 2 (30) Written naming (30)	Novel tests: Spoken word to picture matching (30) Written word to picture matching (30) Reading aloud (30) Word repetition (30) Oral naming: cueing condition 1 (30) Oral naming: cueing condition 2 (30) Written naming (30)
	PALPA 47: Spoken word to picture matching (40) 48: Written word to picture matching (40) 53: Reading aloud (40) 53: Word repetition (40) 53: Oral naming (40) 53: Written naming (40)

Table 7.1: Contents of the battery of tests for aphasic participants (figures in brackets indicate number of test items).

The Pyramids and Palm Trees Test (Howard & Patterson, 1992), a test of non-verbal semantic knowledge, was also included in the test battery. This test explores access to semantics, but knowing the name of the object is not critical. Inclusion of this test enabled assessment data to include details of performance on a judgement task where no spoken or written input or output was necessary. However, it was considered necessary to remove some test items from the original as they were not suitable to be carried out with people from a Bengali culture. Following consultation with members of the bilingual coworker team who were able to comment on potentially biased test items, 14 of the original 52 items were removed. For examples, pictures such as 'slippers' and 'clown' were rejected on grounds of being culturally foreign to Bengali people. That is, one may well find slippers and clowns in Bangladesh but they would not look like the pictures of the western equivalents included in the test. Secondly, pictures such as church and pig

were rejected on grounds of being culturally irrelevant. It is not suggested that Bengali people might not recognise a church or a pig, but it was considered unnecessary to include items that might have been irrelevant or potentially insensitive.

The original version of the test provides normative data, but as these were collected from a white English-speaking population, it was not appropriate to use them in the current context. The adapted version was piloted with the bilingual (Bengali-English speaking) SLT assistant team (n=3) at the Royal London Hospital, where performance was 100%. This test was administered by the bilingual coworkers during the Bengali assessment sessions. This was chosen because, although the test explores non-verbal semantics, instructions must be clarified at the outset. It was anticipated that this would be best achieved by administering the test in the participants' L1. Instructions were drawn up by members of the bilingual coworker team based on the original English text. This script was subsequently fixed during all administrations of the test.

7.6 Administration protocol

Participants were able to choose the venue of the assessment sessions from the following:

- Participant's own home
- The departmental clinic at City University
- The SLT department at the Royal London Hospital

All assessment in English was carried out by the researcher. Assessment of Bengali was administered by a member of the bilingual coworker team and overseen by the researcher. Participants were also asked if they preferred to work with a male or female bilingual coworker and their preference was respected wherever possible. The bilingual coworker was briefed regarding the content of the session immediately before each Bengali assessment. The target language of the assessment was used throughout the session. That is, small talk and test instructions were spoken using the language being assessed. The differences between Sylheti and Standard Bengali were outlined in Chapter 5. Five of the six aphasic participants (Asha excluded) and all of the bilingual coworkers

came from a Sylheti background; therefore with the exception of Asha, all Bengali sessions were delivered using the Sylheti variation. For Asha, the bilingual coworker used the standard variation of Bengali (steps were already taken to ensure the tests targets were the same in both regional variations – see Chapter 6). This in effect meant that the bilingual coworkers led the Bengali assessments, although the researcher contributed greetings and farewells in Bengali. However, if the researcher felt the need to make a comment regarding the administration of the session, English had to be used out of necessity.

The total number of assessment sessions for each participant was between five and six. This depended partly on how quickly the tests were completed by the participant, but also on their willingness to continue. Tests of reading and writing were only administered to participants who reported pre-morbid literacy in the test language. At each session, participants were reminded that they could end the session whenever they chose. However, participants were also encouraged to complete the test they were currently undertaking. The length of each session was between 45-60 minutes. Where tests used the same target words and pictures (albeit in different orders), these were administered in different sessions. When tests required a spoken stimulus, i.e. word repetition and spoken word to picture matching, one repetition was permitted. A minimum of seven days passed between each assessment session to avoid priming effects. Following each Bengali assessment session, the bilingual coworker was debriefed and informed of the next steps. Wherever possible, appointments were arranged to allow the same bilingual coworker to attend all the Bengali assessment sessions for each participant. This allowed a rapport to develop between bilingual coworker and participant.

7.7 Exploration of cueing

The novel spoken naming tests were administered twice in each language to investigate the effects of different types of cue. On occasions where aphasic participants failed to name an item, they were given a cue to ascertain whether extra information

facilitated word retrieval. The oral naming test was carried out in two conditions. In the first condition, when participants failed to name an item, they were given a cross-linguistic cue by the tester. This was the equivalent name for the target in the non-target language. In the second condition, participants were given a semantic cue in the target language. Semantic cues took the form of a brief description of the target item, e.g. target: spoon, semantic cue: 'Used to stir tea'. In each condition, phonemic cues were given when the initial cue failed. Phonemic cues consisted of the first sound of the target word in the target language (e.g. target: frog, phonemic cue: /f/). As the number of suitable items for inclusion in the naming test was so limited, it was not possible to ensure that the number of word-initial consonant clusters was balanced across the two languages. However, as the difference between the tests is fairly small (one cluster in Bengali, five in English), it is unlikely to have had an impact on the data. Additionally, during administration of the PALPA oral naming test, participants were given a phonemic cue when they failed to name an item. In the written naming tests (which were administered only once), participants were given a graphemic cue (the first character of the target word in the target language) when they failed to write an item. All cues were set in advance of testing; therefore each participant potentially had access to the same cues, although in reality each participant experienced word finding difficulties on a different range of target items. All cues were agreed through collaboration with members of the bilingual coworker team. This ensured that cues were accurate in both Bengali and English, and that cues were culturally appropriate. This was especially relevant for semantic cues. These were suggested by the bilingual coworkers, who shared the cultural background of the participants. For example, for the target 'goat', the semantic cue was set as 'animal eaten at celebrations', as this is common in the Muslim Bengali community. Correct responses following cues were recorded separately to uncued naming responses. An evaluation of cueability across languages was carried out using a chi square test for each participant. Each test compared the number of successful cues versus the number of failed

cues across both languages for each participant. Consequently a total of six tests were carried out.

7.8 Collation of data

As the test battery explored a range of language skills, completion of the battery resulted in different types of data depending on the test. Consequently, test data were collated in different formats, as follows:

7.8.1 Spoken and written word to picture matching

These tests required the participant to point to a picture following a stimulus; therefore responses were collated on the basis of category of picture chosen, i.e. target, close semantic distracter, visual distracter, etc. Non-responses were also recorded. Finally, if the participant pointed to a number of pictures related in meaning to the target (i.e. pointed to the target and semantic distracters but unable to make a choice), this was recorded as 'identified semantic group'.

7.8.2 Oral naming

Compared to word to picture matching tests, potential responses in naming tests are far greater. A response on a word to picture matching test cannot be ambiguous – it is either correct or incorrect. A naming response sometimes relies on a judgement by the tester. If the participant's response to a test item matched exactly the anticipated target, this was simply ticked to indicate a correct response. Any other responses were transcribed either orthographically or phonetically. Phonetic transcriptions were carried out by the researcher in both test languages. In Bengali sessions, the need for this was established by an indication from the bilingual coworker administering the test. For the Bengali testing sessions, the bilingual coworker made a judgement whether the response was a valid synonym (similarly to the control data collection format: See Section 6.7.4) in the debriefing following the session. As the naming tests also included an exploration of the effects of cueing, uncued correct responses were distinguished from correct responses following cues. Uncued responses were coded using the following categorisation:

- No response

- Semantic error. An error that was semantically related to the target (e.g. target: dog, response: 'cat').
- Phonological error related to target. Nickels & Howard's (1995b) criterion for coding a phonological error was followed. That is, a response that shares 50% of phonemes in approximately the same order with the target was coded as a phonological error (e.g. target: dog, response: /dɒt/).
- Code switching error. This was an error that could be considered to be a lexical equivalent of the target in the non-target language.
- Code switching semantic error. An error that was semantically related to the target but produced in the non-target language.
- Mixed (semantic/phonological) error. An error that was both semantically and phonologically related to the target.
- Neologism. This included non-words that failed to satisfy the criterion of a phonological error outlined above.
- Perseverative error. A repetition of a response previously produced during the test (regardless of whether it was initially correct or incorrect).
- Unrelated error. Real word responses in the target language that were not semantically or phonologically related to the target.
- Code switching unrelated error. Real word responses in the non-target language that were not semantically related to the target.
- Description (e.g. target: dog, response: 'It's an animal, a type of pet, wags its tail').
- Correct

On occasions when a participant self-corrected a naming error before any comment or cue from the tester had been given, the corrected response was marked as correct. Feedback regarding the correctness of responses was not given. However, if a prompt was required following an incorrect response, the initial response was classed as incorrect.

7.8.3 Written naming

The participants' written responses from the naming test were retained and collated after the session. Analysis mirrors the procedure for the oral naming tests (although a category for orthographic errors replaced that for phonological errors in the oral tests). Likewise, uncued responses were differentiated from responses following a graphemic cue.

7.8.4 Reading aloud and word repetition

Responses to these tests were categorised as either correct or incorrect. A correct response matched the target identically. Deviations from the target were marked incorrect and classified according to error type as with naming responses. These were reviewed for each participant to see if a pattern of errors existed.

7.8.5 Pyramids and Palm Trees Test

As this test (like the word to picture matching tests) requires the participants to point at an appropriate picture, responses were clearly either correct or incorrect. Although some targets had been removed from the original test, the marking schema from the original was retained. Participants received one point for a correct response, zero for an incorrect one, and half for no response. This, in effect, means that a score of 50% (i.e. 19 points in the version modified for this study) reflects performance that is no better than the chance level.

7.9 Results

All participants elected to be assessed at home and all completed or attempted to complete as much of the test battery as was appropriate (i.e. for those without pre-morbid literacy in a language, tests of reading and writing were not carried out in that language).

Table 7.2 is a reminder of the control data for spoken word to picture matching and oral naming tests for both languages. Scores for all aphasic participants for the test battery are presented in Tables 7.3 to 7.6. Table 7.7 compares the aphasic participants' performance on the novel tests in English and their PALPA equivalents. It can be seen that although the novel tests were developed specifically for a Bengali population, there

are in fact no significant differences (using related t-tests) between scores on equivalent tests. There was, however, a trend to slightly higher scores in the novel tests.

Test	Language	Mean correct	Standard Deviation
Spoken word to picture matching	Bengali	29.87	0.35
	English	29.67	0.62
Oral naming	Bengali	27.70	1.75
	English	27.45	2.21

Table 7.2: Control data for spoken word to picture matching and oral naming tests for both Bengali and English.

As the novel naming tests were carried out twice in each language, it was possible to correlate T1 versus T2 administrations of the test. The naming test appears to be reliable in both languages. Although there are some variations between T1 and T2 scores for individual participants (especially Tarik's naming in English), when the data are treated as a group the two administrations of the tests in each language are highly correlated (Pearson r =.957, df = 10, p<=0.01).

There were some cross-linguistic variations in the aphasic uncued naming responses. Naming scores in Bengali and English were compared for each participant using McNemar tests. Each McNemar test incorporated both administrations of the test items. That is, each test included data from four naming tests: T1 and T2 in Bengali and English. This allowed 60 attempts at noun naming in the two languages to be compared, although only 30 separate targets were available (but named twice in each language after T2). Naming test scores were significantly different cross-linguistically for three participants (McNemar test values will be presented individually for each participant where applicable). Rasheda's scores were higher in English, while Salma's and Tarik's scores were higher in Bengali. These variations will be discussed more thoroughly in the following sections, considering each participant on an individual basis. A breakdown of the spoken errors made by all aphasic participants appears in Tables 7.8-7.10.

	Saleha	Salma	Tarik	Rasheda	Azad	Asha
Bengali						
Spoken word to picture matching (30)	22(73.33%)	21(70%)	26(86.67%)	29(96.67%)	30(100%)	29(96.67%)
Close semantic errors	4	3	2	0	0	1
Distant semantic errors	1	0	2	1	0	0
Visual errors	3	0	0	0	0	0
Unrelated errors	0	0	0	0	0	0
No response	0	0	0	0	0	0
Identified semantic group	0	6	0	0	0	0
Written word to picture matching (30)	0(0%)	0(0%)	19(63.33%)	27(90%)	30(100%)	29(96.67%)
Close semantic errors	0	0	1	1	0	1
Distant semantic errors	0	0	1	1	0	0
Visual errors	0	0	0	0	0	0
Unrelated errors	0	0	0	0	0	0
No response	30	30	9	1	0	0
Identified semantic group	0	0	0	0	0	0
Reading aloud (30)	0(0%)	0(0%)	20(66.67%)	29(96.67%)	29(96.67%)	30(100%)
Word repetition (30)	30(100%)	28(93.33%)	28(93.33%)	30(100%)	28(93.33%)	30(100%)
Oral naming 1:						
Uncued (30)	2(6.67%)	7(23.33%)	18(60%)	19(63.33%)	24(80%)	25(83.33%)
Cross-linguistic cue	0(28)	1(23)	1(11)	0(11)	1(5)	0(5)
Phonemic cue	2(28)	8(22)	3(11)	4(11)	2(3)	0(5)
Oral naming 2:						
Uncued (30)	1(3.33%)	10(33.33%)	16(53.33%)	23(76.67%)	25(93.33%)	26(86.67%)
Semantic cue	0(29)	0(20)	4(14)	0(7)	2(5)	0(4)
Phonemic cue	7(29)	10(20)	3(10)	0(7)	1(4)	0(4)
Written naming:						
Uncued (30)	0(0%)	0(0%)	0(0%)	NA	18(60%)	28(93.33%)
Graphemic cue	0	0	0		2(3)	0

Table 7.3: Number correct in Bengali tests for all aphasic participants.
1. Figures in brackets for cueing data indicate total number of cues.
2. NA = Not applicable. Test not carried out due to poor pre-morbid skills for that modality.

	Saleha	Salma	Tarik	Rasheda	Azad	Asha
English						
Spoken word to picture matching (30)	18(60%)	13(43.33%)	22(73.33%)	28(93.33%)	29(96.67%)	29(96.67%)
Close semantic errors	7	1	3	1	0	1
Distant semantic errors	3	0	2	1	0	0
Visual errors	0	0	3	0	1	0
Unrelated errors	2	1	0	0	0	0
No response	0	4	0	0	0	0
Identified semantic group	0	11	0	0	0	0
Written word to picture matching (30)	0(0%)	0(0%)	NA	30(100%)	30(100%)	29(96.67%)
Close semantic errors	0	0		0	0	1
Distant semantic errors	0	0		0	0	0
Visual errors	0	0		0	0	0
Unrelated errors	0	0		0	0	0
No response	30	30		0	0	0
Identified semantic group	0	0		0	0	0
Reading aloud (30)	0(0%)	0(0%)	NA	30(100%)	29(96.67%)	30(100%)
Word repetition (30)	17(56.67%)	23(76.67%)	24(80%)	30(100%)	29(96.67%)	30(100%)
Oral naming 1:						
Uncued (30)	1(3.33%)	1(3.33%)	5(16.67%)	27(90%)	26(96.67%)	27(90%)
Cross-linguistic cue	0(29)	2(25)	3(14)	0(3)	0(4)	0(3)
Phonemic cue	11(29)	16(27)	12(22)	1(3)	3(4)	0(3)
Oral naming 2:						
Uncued (30)	0(0%)	3(10%)	14(46.67%)	27(90%)	23(76.67%)	27(90%)
Semantic cue	0(30)	2(27)	3(16)	1(3)	1(7)	0(3)
Phonemic cue	12(30)	13(25)	2(13)	0(2)	5(6)	0(3)
Written naming:						
Uncued (30)	0(0%)	0(0%)	NA	25(83.33%)	15(50%)	29(96.67%)
Graphemic cue	0	0		0(5)	0	0(0)

Table 7.4: Number correct in English tests for all aphasic participants.
1. Figures in brackets for cueing data indicate total number of cues.
2. NA = Not applicable. Test not carried out due to poor pre-morbid skills for that modality.

PALPA	Saleha	Salma	Tarik	Rasheda	Azad	Asha
47: Spoken word to picture matching (40)	22(55%)	18(45%)	32(80%)	37(92.5%)	36(90%)	37(92.5%)
Close semantic errors	11	7	5	2	1	3
Distant semantic errors	1	0	2	1	1	0
Visual errors	5	4	0	0	1	0
Unrelated errors	1	0	0	0	0	0
No response	0	11	1	0	1	0
Identified semantic group	0	0	0	0	0	0
48: Written word to picture matching (40)	0(0%)	0(0%)	NA	34(85%)	39(97.5%)	38(95%)
Close semantic errors	0	0		4	1	2
Distant semantic errors	0	0		0	0	0
Visual errors	0	0		0	0	0
Unrelated errors	0	0		0	0	0
No response	30	30		2	0	0
Identified semantic group	0	0		0	0	0
53: Reading aloud (40)	0(0%)	0(0%)	NA	38(95%)	36(90%)	40(100%)
53: Word repetition (40)	31(77.5%)	28(70%)	16(40%)	39(97.5%)	35(87.5%)	40(100%)
53: Oral naming (40)	0(0%)	1(2.5%)	11(27.5%)	32(80%)	27(67.5%)	35(87.5%)
Phonemic cue	18(40)	24/39	13(29)	0(8)	1(13)	0(5)
53: Written naming (40)	0(0%)	0(0%)	NA	34(85%)	16(40%)	34(85%)

Table 7.5: Number correct the PALPA tests for all aphasic participants.
1. Figures in brackets for cueing data indicate total number of cues.
2. NA = Not applicable. Test not carried out due to poor pre-morbid skills for that modality.

	Saleha	Salma	Tarik	Rasheda	Azad	Asha
Pyramids and Palm Trees (38)	22(57.89%)	25.5(67.11%)	26.5(69.74%)	28.5(75%)	31.5(82.89%)	34(89.47%)

Table 7.6: Number correct on the Pyramids and Palm Trees test for all aphasic participants.
1. Chance score = 19(50%).

	Mean English (%)	Mean PALPA (%)	t =	p =
Spoken word to picture matching	77.17	76.00	0.550	0.606
Written word to picture matching	59.40	55.60	1.340	0.251
Reading aloud	59.40	57.00	1.596	0.186
Word repetition	85.17	79.00	0.766	0.479
Oral naming	49.00	44.50	1.114	0.316
Written naming	46.00	44.60	0.573	0.597

Table 7.7: Comparison of scores for novel tests in English versus PALPA equivalents.

		Semantic	No response	CS semantic	CS	Phonological	Mixed	Neologism	Perseveration	Visual	Unrelated	CS unrelated	Correct
Saleha	Bengali 1	2(7.1%)	26(92.9%)										2(6.7%)
	Bengali 2	2(6.9%)	24(82.8%)	1(3.4%)					2(6.9%)				1(3.3%)
	English 1		28(96.6%)			1(3.4%)							1(3.3%)
	English 2		30(100%)										0(0%)
	PALPA		40(100%)										0(0%)
Salma	Bengali 1	1(4.35%)	21(91.3%)	1(4.35%)									7(23.3%)
	Bengali 2	5(25%)	12(60%)			2(10%)			1(5%)				10(33.3%)
	English 1		24(82.8%)		3(10.3%)	1(3.45%)		1(3.45%)					1(3.3%)
	English 2		19(70.4%)		5(18.5%)	1(3.7%)		1(3.7%)	1(3.7%)				3(10%)
	PALPA		34(87.2%)			3(7.7%)			1(2.55%)		1(2.55%)		1(2.5%)
Tarik	Bengali 1	3(25%)	6(50%)	1(8.33%)	1(8.33%)	1(8.33%)							18(60%)
	Bengali 2	5(35.7%)	5(35.7%)		4(28.6%)								16(53.3%)
	English 1	3(12%)	9(36%)	1(4%)	9(36%)	2(8%)						1(4%)	5(16.7%)
	English 2	1(6.3%)	13(81.3%)		2(12.5%)								14(46.7%)
	PALPA	8(34.8%)	3(13%)	1(4.35%)	10(43.5%)	1(4.35%)							17(42.5%)
Rasheda	Bengali 1	4(36.4%)	7(63.6%)										19(63.3%)
	Bengali 2	3(42.8%)	2(28.6%)		2(28.6%)								23(76.7%)
	English 1	3(100%)											27(90%)
	English 2	3(100%)											27(90%)
	PALPA	2(25%)	5(62.5%)							1(12.5%)			32(80%)
Azad	Bengali 1	2(33.3%)	1(16.7%)		2(33.3%)							1(16.7%)	24(80%)
	Bengali 2	3(60%)	2(40%)										25(83.3%)
	English 1	2(50%)	1(25%)		1(25%)								26(86.7%)
	English 2	2(28.6%)	3(42.8%)		1(14.3%)	1(14.3%)							23(76.7%)
	PALPA	7(53.8%)	3(23.1%)			2(15.4%)	1(7.7%)						27(67.5%)
Asha	Bengali 1	3(60%)	1(20%)							1(20%)			25(83.3%)
	Bengali 2	3(75%)								1(25%)			26(86.7%)
	English 1	1(33.3%)								1(33.3%)	1(33.3%)		27(90%)
	English 2	1(33.3%)								1(33.3%)	1(33.3%)		27(90%)
	PALPA	3(60%)	1(20%)							1(20%)			35(87.5%)

Table 7.8: Breakdown of uncued oral naming responses.

1. CS = code switching.
2. Figures in brackets for error data are proportions of all errors (%) for that test for each participant.
3. Figures in brackets for number correct are the percentage of correct responses for each participant.

		Semantic	No response	Graphemic	Mixed	Visual	Correct
Saleha	Bengali		30(100%)				0(0%)
	English		30(100%)				0(0%)
	PALPA		40(100%)				0(0%)
Salma	Bengali		30(100%)				0(0%)
	English		30(100%)				0(0%)
	PALPA		40(100%)				0(0%)
Tarik	Bengali		30(100%)				0(0%)
	English						NA
	PALPA						NA
Rasheda	Bengali						NA
	English	2(40%)	1(20%)	1(20%)	1(20%)		25(83.3%)
	PALPA	2(33.3%)	1(16.6%)	2(33.3%)	1(16.6%)		34(85%)
Azad	Bengali	2(16.6%)	3(25%)	6(50%)		1(8.3%)	18(60%)
	English	3(20%)	1(6.6%)	10(66.6%)		1(6.6%)	15(50%)
	PALPA	3(12.5%)	10(41.6%)	10(41.6%)	1(4.2%)		16(40%)
Asha	Bengali	1(50%)				1(50%)	28(93.3%)
	English					1(100%)	29(96.7%)
	PALPA			4(66.6%)		2(33.3%)	34(85%)

Table 7.9: Breakdown of uncued written naming responses.
1. Figures in brackets for error data are proportions of all errors (%) for that test for each participant.
2. Figures in brackets for number correct are the percentage of correct responses for each participant.
3. Errors were coded as graphemic when 50% of the correct graphemes were produced.

		No response	Phonological	Correct
Saleha	Bengali			0(0%)
	English			0(0%)
	PALPA			0(0%)
Salma	Bengali	30(100%)		0(0%)
	English	30(100%)		0(0%)
	PALPA	40(100%)		0(0%)
Tarik	Bengali	2(20%)	8(80%)	20(66.6%)
	English			NA
	PALPA			NA
Rasheda	Bengali	1(100%)		29(96.7%)
	English			30(100%)
	PALPA	1(50%)	1(50%)	38(95%)
Azad	Bengali		1(100%)	29(96.7%)
	English		1(100%)	29(96.7%)
	PALPA		4(100%)	36(90%)
Asha	Bengali	30(100%)		30(100%)
	English	30(100%)		30(100%)
	PALPA	40(100%)		40(100%)

Table 7.10: Breakdown of reading aloud test responses.
1. Figures in brackets for error data are proportions of all errors (%) for that test for each participant.
2. Figures in brackets for number correct are the percentage of correct responses for each participant.

		No response	Phonological: Non-word	Phonological: Real-word in target language	Phonological: Real-word in non-target language	Correct
Saleha	Bengali					30(100%)
	English	4(30.8%)	5(38.5%)	4(30.6%)		17(56.7%)
	PALPA		1(11.1%)	7(77.8%)	1(11.1%)	31(77.5%)
Salma	Bengali			2(100%)		28(93.3%)
	English		2(28.6%)	3(42.8%)	2(28.6%)	23(76.7%)
	PALPA	1(8.3%)	8(66.6%)	1(8.3%)	2(16.6%)	28(70%)
Tarik	Bengali		2(100%)			28(93.3%)
	English		2(33.3%)	3(50%)	1(16.7%)	24(80%)
	PALPA	3(12.5%)	4(16.7%)	12(50%)	5(20.8%)	16(40%)
Rasheda	Bengali					30(100%)
	English					30(100%)
	PALPA			1(100%)		39(97.5%)
Azad	Bengali		1(50%)		1(50%)	28(93.3%)
	English			1(100%)		29(96.7%)
	PALPA		1(20%)	4(80%)		35(87.5%)

Table 7.11: Breakdown of word repetition test responses.
1. Figures in brackets for error data are proportions of all errors (%) for that test for each participant.
2. Figures in brackets for number correct are the percentage of correct responses for each participant

Also of interest is the question of whether the estimated low frequency words were more difficult than the high frequency words. The latency data from the test development phase (Section 6.7.3) resulted in a broadly equal number of words from the estimated high and low frequency groups that were used as targets for the aphasia tests. The data in Table 7.12 indicate that as a group, participants did not make significantly (established using unpaired t-tests) more errors in either language on the low frequency items than on the high frequency words. However, one should note a trend towards more errors being made for low rather than high frequency items in both languages. Even participants with the most severe aphasia (Salma and Saleha), i.e. those one might expect to be most likely to struggle with accessing low frequency words, did not make significantly fewer errors on high frequency words. Such a finding is unremarkable, as the test development phase sought to identify a body of words that members of London's bilingual Bengali community were likely to name in both languages. The 29 'high' frequency and 31 'low' frequency words included in the aphasia tests were the only targets from the initial 150

that qualified for inclusion following the test development data analysis; therefore it is unsurprising that the balance of errors of the aphasic participants test scores broadly reflected those of the control participants.

Comprehension Tests	English		Bengali	
Estimated Frequency	high (n=15)	low (n=15)	high (n=15)	low (n=15)
Spoken word to picture matching				
Saleha	6(40%)	6(40%)	5(33.3%)	3(20%)
Salma	6(40%)	11(73.3%)	4(26.7%)	5(33.3%)
Tarik	4(26.7%)	4(26.7%)	3(20%)	1(6.7%)
Rasheda	0(0%)	2(13.3%)	0(0%)	1(6.7%)
Azad	0(0%)	1(6.7%)	0(0%)	0(0%)
Asha	0(0%)	1(6.7%)	0(0%)	1(6.7%)
Unpaired t-test: high versus low frequency	t = .7498; p = NS		t = .1382; p = NS	
Written word to picture matching				
Saleha	--	--	--	--
Salma	--	--	--	--
Tarik	NA	NA	6(40%)	5(33.3%)
Rasheda	0(0%)	0(0%)	0(0%)	3(20%)
Azad	0(0%)	0(0%)	0(0%)	0(0%)
Asha	0(0%)	0(0%)	0(0%)	1(6.7%)
Unpaired t-test: high versus low frequency	NA		t = .4023; p = NS	
Reading aloud				
Saleha	--	--	--	--
Salma	--	--	--	--
Tarik	NA	NA	3(20%)	7(46.7%)
Rasheda	0(0%)	0(0%)	0(0%)	1(6.7%)
Azad	0(0%)	1(6.7%)	0(0%)	1(6.7%)
Asha	0(0%)	0(0%)	0(0%)	0(0%)
Unpaired t-test: high versus low frequency	NA		t = .8504; p = NS	
Expression tests	English		Bengali	
Estimated Frequency	high (n=14)	low (n=16)	high (n=14)	low (n=16)
Oral naming 1				
Saleha	14(100)%	15(93.8%)	13(92.9%)	15(93.8%)
Salma	13(92.9%)	16(100%)	8(57.1%)	15(93.8%)
Tarik	12(87.5%)	13(81.3%)	5(35.7%)	7(43.8%)
Rasheda	0(0%)	3(18.8%)	3(21.4%)	8(50%)
Azad	1(7.1%)	3(18.8%)	3(21.4%)	3(18.8%)
Asha	3(21.4%)	0(0%)	2(14.3%)	3(18.8%)
Unpaired t-test: high versus low frequency	t = .0356; p = NS		t = .6880; p = NS	
Oral naming 2				
Saleha	14(100)%	16(100%)	14(100)%	15(93.8%)
Salma	12(87.5%)	15(93.8%)	7(50%)	13(81.3%)
Tarik	8(57.1%)	8(50%)	7(50%)	7(43.8%)
Rasheda	1(7.1%)	2(12.5%)	3(21.4%)	8(50%)
Azad	3(21.4%)	4(25%)	2(14.3%)	3(18.8%)
Asha	3(21.4%)	0(0%)	2(14.3%)	2(12.5%)
Unpaired t-test: high versus low frequency	t = .0818; p = NS		t = .2165; p = NS	
Word repetition				
Saleha	5(35.7%)	8(50%)	0(0%)	0(0%)
Salma	2(14.3%)	4(25%)	1(7.1%)	1(6.3%)
Tarik	2(14.3%)	4(25%)	0(0%)	2(12.5%)
Rasheda	0(0%)	0(0%)	0(0%)	0(0%)
Azad	1(7.1%)	0(0%)	0(0%)	2(12.5%)
Asha	0(0%)	0(0%)	0(0%)	0(0%)
Unpaired t-test: high versus low frequency	t = .4793; p = NS		t = 1.4538; p = NS	
Written naming				
Saleha	--	--	--	--
Salma	--	--	--	--
Tarik	NA	NA	--	--
Rasheda	0(0%)	4(25%)	NA	NA
Azad	6(42.9%)	9(56.3%)	3(21.4%)	9(56.3%)
Asha	1(7.1%)	0(0%)	1(7.1%)	1(6.3%)
Unpaired t-test: high versus low frequency	t = .4793; p = NS		t = .6557; p = NS	

Table 7.12: Breakdown of test errors comparing 'high' versus 'low' frequency groups and corresponding unpaired t-test results (notes overpage).

1. Although reading aloud test is not a test of comprehension, it included the same test items as the comprehension tests.
2. Figures in brackets indicate the percentage of total targets for that frequency group.
3. NA = Not applicable.
4. NS = not significant.

Table 7.13 collates participants' oral naming test scores in Bengali and English with code-switching errors in the two languages. Two participants made no code-switching errors in either language. For the remaining participants who did make code-switching errors, a consistent pattern emerges. There is a tendency for the direction of code-switching errors to match participants' language preference. When a participant scored higher in Bengali oral naming than English (i.e. Salma and Tarik), he or she made more code-switching errors by switching *into* their preferred language. Likewise, Rasheda scored higher in English than Bengali and only made code-switching errors by switching into English. A fourth participant, Azad, scored evenly in the two languages and also made the same number of code-switching errors in the two languages.

	Salma	Saleha	Tarik	Rasheda	Azad	Asha
Naming scores						
Bengali						
Oral naming 1 (30)	7	2	18	19	24	25
Oral naming 2 (30)	10	1	16	23	25	26
English						
Oral naming 1 (30)	1	1	5	27	26	27
Oral naming 2 (30)	3	0	14	27	23	27
Code switching errors						
Bengali						
Oral naming 1 (30)	0	0	1(8.33%)	0	2(33.3%)	0
Oral naming 2 (30)	0	0	4(28.6%)	2(28.6%)	0	0
English						
Oral naming 1 (30)	3(10.3%)	0	9(36%)	0	1(25%)	0
Oral naming 2 (30)	5(18.5%)	0	2(12.5%)	0	1(14.3%)	0

Table 7.13: Collated oral naming test scores and code-switching errors for aphasic participants.
1. Bracketed figured indicate percentage of total errors for each test

7.9.1 Saleha

Table 7.14 is a reminder of Saleha's scores on the test battery. Saleha's performance indicates a severe language impairment. Indeed, the assessment data indicate that the damage to her language processing system is likely to be widespread and extensive. Her score on the Pyramids and Palm Trees Test was no better than the chance level.

Saleha	Bengali	English	PALPA
Spoken word to picture matching	22	18	22
Close semantic errors	4	7	11
Distant semantic errors	1	3	1
Visual errors	3	0	5
Unrelated errors	0	2	1
No response	0	0	0
Identified semantic group	0	0	0
Written word to picture matching	0	0	0
Close semantic errors	0	0	0
Distant semantic errors	0	0	0
Visual errors	0	0	0
Unrelated errors	0	0	0
No response	30	30	30
Identified semantic group	0	0	0
Reading aloud	0	0	0
Word repetition	30	17	31
Oral naming 1:			
Uncued	2	1	0
Cross-linguistic cue	0(28)	0(29)	
Phonemic cue	2(28)	11(29)	18(40)
Oral naming 2:			
Uncued	1	0	
Semantic cue	0(29)	0(30)	
Phonemic cue	7(29)	12(30)	
Written naming:			
Uncued	0	0	0
Graphemic cue	0	0	

Table 7.14: Saleha's test battery scores.
1. Novel tests include 30 items per test; PALPA includes 40 items per test.
2. Figures in brackets for cueing data indicate total number of cues.

Saleha was entirely unable to do all tests of reading or writing. She rated herself as a poor pre-morbid reader of English, but after ten years of education in Bangladesh and a self-rating of "very good" literacy in Bengali, it is likely she would have performed in the normal range for the Bengali literacy tests pre-morbidly. This was a similar pattern of performance on the reading tests to Salma, and will be discussed later in Section 7.10.2.

Given that Saleha performed so poorly on most of the test battery in both languages, her scores on the spoken word to picture matching tests clarify that she retains sufficient access to a lexicon, semantic system, and visual object recognition system to differentiate the target from a range of distracters at above the chance level. However, Saleha's errors on these tests are informative. She chose the close semantic distracter more often in both languages (and the PALPA) than any of the other aphasic participants.

One might infer from this that on items where the spoken input does not activate sufficient semantic nodes to identify the correct picture, the input does at least often activate some of the relevant semantic nodes associated with the input word. If activation of semantic nodes remains incomplete, the nodes that have been activated reduce the number of contenders to choose from. For example, for the English target 'donkey', Saleha chose 'zebra' (in preference to 'cow', 'ironing board', and 'iron'). This implies that a number of semantic connections have been activated (e.g. animal, four legs, equine) to exclude the other alternatives, but activated connections are insufficient to differentiate the target from items with a high number of shared semantic nodes. Considering the query raised above regarding a possible visual neglect, it is notable that Saleha also chose some visual distracters in the Bengali and PALPA word to picture matching tests. However, there is no pattern to the placement on the page of either the target or the visual distracter on these items. That is, it is not the case that Saleha has a restricted visual field that impairs her ability to see all the pictures on the page.

There is a highly significant difference (McNemar test: $\chi^2 = 13$, $df = 1$, $p<=.001$) in Saleha's performance in the word repetition tests in the two languages. She made no errors in Bengali but 13 in English. Saleha is the only participant to show a striking dissociation between word repetition in English versus Bengali. Bengali word repetition was at ceiling – the only test in the battery that Saleha completed without difficulty. Conversely, word repetition in English was poor (56%). This low score in English may be the result of a particularly poor day, but her score on the PALPA equivalent test (although higher) was also below ceiling (77%). Errors in both English word repetition tests were all phonological. As there is a clear dissociation between repetition in the two languages, this implies that Saleha does not have access to a non-lexical route for word repetition. If she did, repetition ability would not differ for the two languages, as processing would be carried out independently of the lexicons. If Saleha was unable to access a non-lexical route for word repetition, one would predict that she would be unable to repeat non-words effectively. Unfortunately data are unavailable to confirm this prediction, as only the tests included in the battery were carried out with each participant. However, the absence of a

non-lexical route for repetition cannot alone account for Saleha's repetition difficulties. There must also be a breakdown in Saleha's lexical processing route. She can repeat Bengali words without difficulty; therefore this indicates that the Bengali input and output lexicons must be intact. Conversely, either the input or output lexicon in English must be damaged. For Saleha to be unable to consistently repeat in English, both lexical and non-lexical routes must be damaged. It could be the case that Saleha's English lexical route is not available, although the presence of some lexical skills in English does not support this suggestion. She can understand English words above chance and can be cued to name in English. This indicates that Saleha still has access to some English lexical components, so she probably has partial access to the English repetition route. As Saleha's lexical route for Bengali appears to be intact, she does not need to draw on the compromised non-lexical route for word repetition in this language.

Saleha experienced severe word finding difficulties in all oral naming tests in both Bengali and English. She was unable to make a response for most targets without a cue. Her errors in Bengali that were not no responses included semantic, code switching-semantic or perseverative errors. Unfortunately there is relatively limited scope for interpretation of Saleha's word naming scores, simply because her word finding difficulties are so severe that she was unable to make a response for the majority of test items in both languages. Saleha was often able to demonstrate that she recognised the item from the picture by gesturing function but she was unable to produce many spoken responses beyond stock phrases such as "I know it". This indicates an impairment between semantics and the POL. In Bengali, Saleha produced marginally more semantic errors than correct responses. She did not make semantic errors in English, but it is likely that this is due to the severe difficulties she experiences in making words available for production. That is, in addition to the target, competitors are also receiving insufficient activation to allow production. In addition to having severe word finding difficulties, Saleha's naming is also inconsistent. In four administrations of the novel naming test (i.e. twice in both Bengali and English), Saleha failed to name a single item more than once. This does indicate, though, that Saleha's difficulty is one of access to representations.

This argument is supported by Saleha's positive response to cueing, at least in English. If resources required to activate a representation are fluctuating, this could account for Saleha's ability to name an item on one occasion but not on others. Saleha was the only participant who showed a differential response to cueing – she was significantly better at responding to cues in English than Bengali. This unusual result will be considered later with other participants' responses to cues in Section 7.10.3.4.

7.9.2 Salma

Table 7.15 is a reminder of Salma's scores on the test battery. Her score on the Pyramids and Palm Trees Test was barely above chance level. Salma has a severe anomia, and the assessment data indicate that word finding is breaking down at both the semantic and phonological levels, as well as connections to literacy being severed. There is no evidence of vision impairment or visual recognition difficulties, therefore one could suggest that Salma finds it difficult to activate sufficient semantic connections between a pair to exclude a less closely related item. Salma was completely unable to complete tests with a written stimulus or requiring a written response (this pattern of complete reading 'failure' will be discussed from a cultural perspective in Section 7.10.2).

Salma	Bengali	English	PALPA
Spoken word to picture matching	21	13	18
Close semantic errors	3	1	7
Distant semantic errors	0	0	0
Visual errors	0	0	4
Unrelated errors	0	1	0
No response	0	4	11
Identified semantic group	6	11	0
Written word to picture matching	0	0	0
Close semantic errors	0	0	0
Distant semantic errors	0	0	0
Visual errors	0	0	0
Unrelated errors	0	0	0
No response	30	30	30
Identified semantic group	0	0	0
Reading aloud	0	0	0
Word repetition	28	23	28
Oral naming 1:			
Uncued	7	1	1
Cross-linguistic cue	1(23)	2(25)	
Phonemic cue	8(22)	16(27)	24(39)
Oral naming 2:			
Uncued	10	3	
Semantic cue	0(20)	2(27)	
Phonemic cue	10(20)	13(25)	
Written naming:			
Uncued	0	0	0
Graphemic cue	0	0	

Table 7.15: Salma's test battery scores.
1. Novel tests include 30 items per test; PALPA includes 40 items per test.
2. Figures in brackets for cueing data indicate total number of cues.

Salma's performance on the spoken word to picture matching tests indicates that, although impaired, she can demonstrate some understanding at the single word level. However, her score on the spoken word to picture matching test in Bengali was significantly higher (McNemar test: $\chi^2 = 6.4$, $df = 1$, $p = <.05$) than her score on the English equivalent. Her word to picture matching errors followed a similar profile in both languages. Many of Salma's errors were semantic. Three were close semantic errors; she was unable to make a choice (but discounted semantically unrelated items) for the remaining errors. This pattern of identifying the semantic trio occurred more often in English than Bengali. Salma also chose semantic distracters in both languages and especially in the PALPA. Semantic processing is breaking down, but not to the point where Salma randomly chooses any picture. Some semantic activation (albeit often

insufficient to identify the target) allows Salma to largely avoid choosing visual and unrelated distracters. This pattern was similar for tests in both languages, thereby strengthening the argument for shared semantic processing in bilinguals.

Salma made word repetition errors in both languages. In Bengali, Salma only made target language real word errors. These errors could arise from selecting phonological neighbours from the Bengali POL. In addition to making target language real word errors in English, Salma also made phonologically related non-target language real word errors and phonologically related non-word errors. Again, the target language real word errors could occur as a result of selecting a near neighbour from the English POL. Phonologically related errors could also arise from breakdown in the English POL. It could be the case that the representation for a target word has been damaged. When producing such phonologically related non-words, Salma generally did not accept her own response. This could arise as a result of self monitoring. Representations in the phonological input lexicon could still be intact, and consequently she recognised her initial response (for which there would be no entry in the input lexicon) as incorrect. However, although Salma often rejected her repetition errors, she was rarely able to correct them. An alternative explanation could be that Salma experiences a breakdown in phonological encoding processes, where incorrect phonemes are realised following selection of an intact representation of the target from the target language POL.

Oral naming was severely impaired in both languages, although test scores were significantly lower (McNemar test, $\chi^2 = 11.27$, $df = 1$, $p = <0.001$) for English than Bengali. This suggests that Salma may have a differential impairment. Even though Bengali was the only language Salma learnt in infancy, she began to learn English before adolescence when she migrated to the UK with her family and was evidently a competent English speaker before her stroke. One should acknowledge here, however, that Salma rated her pre-morbid English ability as lower than her Bengali skills. In any case, the methodology of developing the test took steps to ensure that targets were highly likely to be named in both languages by members (excluding minimal bilinguals) of the London Bengali community.

The breakdown of Salma's naming errors in Table 7.8 also indicates a differential profile for each language. Salma only made semantic errors in Bengali. The accumulating evidence discussed in this section indicates that Salma has a semantic impairment, but why, given the compelling evidence for shared semantic processing in bilinguals (Section 3.6), does Salma not make semantic errors in English? A difficulty with differentiating semantically connected items in English (and Bengali) was evident in Salma's performance on the word to picture matching tests, so one might have expected to find semantic naming errors in English in addition to Bengali. However, rather than indicating intact semantic processing for English naming, the more feasible interpretation is that Salma's English naming is so impaired that the opportunities to make a semantic error are greatly reduced. From 100 English naming targets in the battery (i.e. the two administrations of the novel naming test and the PALPA 53), Salma failed to respond 77 times.

Regardless of which model one considers, it is possible that insufficient activation is reaching phonological nodes to make an English item available. Indeed, it is highly likely that Salma's code switching errors in English (contrasted to none at all in Bengali) are related to difficulties in completing access for English targets. However, on several items Salma pointed to a real example (e.g. nose) or gestured the function (e.g. imitating turning key in lock) of the target. This implies that the central semantic processing module has received sufficient activation to identify the target (without need to consider the target language), therefore the breakdown must occur later in the process, possibly in the English POL in Green's (1986) model. Given the evidence of a semantic impairment, one might consider a level of lexical-semantic processing (as shown in the unilingual model in Figure 2.3) that occurs before a phonological output is retrieved. However, a breakdown in lexical semantics cannot account for Salma's poor performance in the Pyramids and Palm Trees test, as this, in theory, is a test of non-linguistic semantic processing. That is, accessing conceptual semantics should be sufficient to provide the understanding required to complete the test without progressing to lexical semantics. Likewise, the semantic deficit cannot be confined to central semantics. At this stage, it

might be most appropriate to accept that Salma's language impairment is both severe and multifactorial. Consequently, several aspects of her language processing may be compromised. Certainly, in addition to semantic processing difficulties, there is evidence of a phonological disturbance in both languages. Salma made phonological errors in both Bengali and English and a small number of neologisms in English only.

7.9.3 Tarik

Tarik	Bengali	English	PALPA
Spoken word to picture matching	26	22	32
Close semantic errors	2	3	5
Distant semantic errors	2	2	2
Visual errors	0	3	0
Unrelated errors	0	0	0
No response	0	0	1
Identified semantic group	0	0	0
Written word to picture matching	19	NA	NA
Close semantic errors	1		
Distant semantic errors	1		
Visual errors	0		
Unrelated errors	0		
No response	9		
Identified semantic group	0		
Reading aloud	20	NA	NA
Word repetition	28	24	16
Oral naming 1:			
Uncued	18	5	11
Cross-linguistic cue	1(11)	3(14)	
Phonemic cue	3(11)	12(22)	13(29)
Oral naming 2:			
Uncued	16	14	
Semantic cue	4(14)	3(16)	
Phonemic cue	3(10)	2(13)	
Written naming:			
Uncued	0	NA	NA
Graphemic cue	0		

Table 7.16: Tarik's test battery scores.

1. Novel tests include 30 items per test; PALPA includes 40 items per test.
2. Figures in brackets for cueing data indicate total number of cues.

Of all the aphasic participants, Tarik was the participant most likely to be susceptible to spontaneous recovery during the project. Although he met the participation requirement of being at least six months post-onset, his was by far the most recent stroke of the group. Only the novel naming tests were repeated in each language, therefore it is unclear how unstable Tarik's performance was in the other modalities.

Table 7.16 is a reminder of Tarik's scores on the test battery. Tarik's performance on the spoken word to picture matching tests in both languages was a relative strength, but his scores indicate an impairment in comparison to the control data. In Bengali, all of Tarik's spoken word to picture matching errors were semantic. In the English equivalent, which resulted in a lower score than in Bengali, most errors were again semantic, with the addition of a small number of visual errors.

Tarik's performance in the Bengali reading aloud test was also impaired. The majority of Tarik's errors in this test were a production of a monosyllable that resulted in a non-word. On four of these occasions, Tarik produced the appropriate initial syllable of the target word but was unable to complete it. Four other monosyllabic errors included a combination of incorrect phoneme errors (i.e. consonant and vowel both incorrect (2), correct consonant, incorrect vowel (1), incorrect consonant, correct vowel (1)).

Tarik's Bengali word repetition was close to ceiling. All errors were phonological, including errors of phoneme substitution (target: house, response: /saus/; target: camel, response: /kʌmɒn/) and deletion (target: owl, response: /au/). Tarik's score on the PALPA word repetition test contained many more errors than the novel English test.

Tarik's oral naming in English was significantly lower (McNemar test, $\chi^2 = 5.76$, $df=1$, $p= <0.05$) than Bengali, although both languages are impaired. However, he demonstrated a more consistent performance in Bengali than English over two administrations of the tests. Excluding no responses, most errors in Bengali were semantic (e.g. target: /xɔ:gu:ʃ/ ('rabbit'), response: /bɪræl/ ('cat')). His error profile also included a small number of code switching semantic errors (e.g. target: /æŋɔ:/ ('grapes'), response: 'apple') and phonological errors (target: /su:l/ ('hair'), response: /tʊl/ (non-word)). The profile of errors was similar in English naming, including semantic (e.g. target: letter, response: 'book'), code switching-semantic (target: swan, response: /a:ʃ/ ('duck')), code switching, and phonological (target: tiger, response: /taɪbə/ (non-word)) errors. Tarik made more code switching errors in the English naming tests. His error

profile in the PALPA naming test was similar to the novel English tests, including code switching, code switching-semantic (e.g. target: thumb, response: /æŋʊl/ ('finger')), semantic (e.g. target: fork, response: 'knife'), and phonological (e.g. target: bear, response: /bɒnɒ/).

In the double administration of the naming tests, it is clear that Tarik's noun naming in Bengali was far more stable (albeit clearly impaired when compared to the control data) than in English. However, any claim of a differential impairment must come with the proviso that Tarik's second attempt on the English naming test was much more in line with his scores in Bengali. Since his stroke, Tarik had used essentially no English. He had been largely housebound, where he used Bengali with all his family and also watched TV in Bengali via cable. His SLT treatment before participating in the current project was carried out solely in Bengali. Although English is obviously the environmentally dominant language in London, Tarik appears to have had very little reason to use it. Given this background, it becomes less unexpected that Tarik performed poorly in what may have been his first productive use of English in over six months. Tarik rated his pre-morbid skills in English lower than in Bengali and he did not begin to learn English until his late teens, therefore a profile reflecting a dominance of Bengali is unsurprising.

Although Tarik made many code-switching errors in English, he made very few code-switching semantic errors in either language. In order to produce the lexical equivalent of a target in the non-target language, sufficient semantic nodes must have been activated to identify the correct concept before the activation breakdown occurs that results in the code-switching error.

Tarik was completely unable to respond to the written naming test in Bengali (he could not read English pre-morbidly; therefore the English equivalent tests were not carried out). However, he was able to complete the Bengali written word to picture matching and reading aloud tests. Word reading appears to be largely an all or nothing process for Tarik. Of the 21 items on the written word to picture matching test for which he made a response, all bar two of them were correct. For the remaining two responses, he

made the same semantic error that he made on the Bengali spoken word to picture matching task. For the items where Tarik failed to make a response, it was clear from his evident confusion that he had been unable to decode the word. As reading aloud was not permitted during the written word to picture matching tests, Tarik was not able to use the grapheme-to-phoneme route to facilitate reading. Although Bengali orthography is quite regular, he was unable to decode the words by breaking them down into graphemes. In order to provide a correct response, one must access semantics via the orthographic input lexicon. For inputs that Tarik failed to decode, it could be the case that the accessing of certain items in the lexicon is interrupted. Alternatively, there could be some selective damage to some representations themselves in the lexicon.

A similar breakdown was evident in the Bengali reading aloud task. For items that Tarik recognised, he provided the correct response quickly and easily. On items that he failed to decode, he often (n=8, 27% of test items) demonstrated partial decoding of the written input by producing some correct phonemes, but on these occasions he failed to segment the input into graphemes for individual decoding. On this task, it is possible to use either the lexical or non-lexical route to complete the task. Tarik's performance on the written word to picture matching test may indicate that his access to the orthographic input lexicon is potentially damaged. From the reading aloud test, one can additionally infer that the grapheme-to-phoneme route is also compromised. The items where Tarik responded correctly in the written word to picture matching test correspond almost exactly (95%) with the items that Tarik read aloud correctly. This indicates that if the item is inaccessible in the orthographic input lexicon, Tarik is unable to use the grapheme-to-phoneme conversion route. The conversion route might, however, allow Tarik to produce one or two phonemes of the target, but it appears to be too damaged to facilitate the conversion of an entire word.

7.9.4 Rasheda

Rasheda	Bengali	English	PALPA
Spoken word to picture matching	29	28	37
Close semantic errors	0	1	2
Distant semantic errors	1	1	1
Visual errors	0	0	0
Unrelated errors	0	0	0
No response	0	0	0
Identified semantic group	0	0	0
Written word to picture matching	27	30	34
Close semantic errors	1	0	4
Distant semantic errors	1	0	0
Visual errors	0	0	0
Unrelated errors	0	0	0
No response	1	0	2
Identified semantic group	0	0	0
Reading aloud	29	30	38
Word repetition	30	30	39
Oral naming 1:			
Uncued	19	27	32
Cross-linguistic cue	0(11)	0(3)	
Phonemic cue	4(11)	1(3)	0(8)
Oral naming 2:			
Uncued	23	27	
Semantic cue	0(7)	1(3)	
Phonemic cue	0(7)	0(2)	
Written naming:			
Uncued	NA	25	34
Graphemic cue		0(5)	

Table 7.17: Rasheda's test battery scores.
1. Novel tests include 30 items per test; PALPA includes 40 items per test.
2. Figures in brackets for cueing data indicate total number of cues.

Rasheda's is an unusual case of aphasia, as she was only 15 when she had her stroke. Her language impairment is both high level and subtle. This is consistent with the findings of several studies exploring people who become aphasic at an early age (but after language acquisition). Impairments are often subtle, and persist throughout adulthood (Watamori, Sasanuma, & Ueda, 1990; Lees, 1993; Fabbro, 2004). Table 7.17 is a reminder of Rasheda's scores on the test battery. She demonstrated a high but not error-free performance on spoken and written word to picture matching in English and Bengali. It is notable that, excluding a small number of no responses, all picture matching errors were semantic for both languages. This profile is reinforced by the PALPA picture

matching tests, where all errors were again semantic distracters. Tests of reading aloud and word repetition were at or close to ceiling in both languages.

Her relatively poor performance on the Pyramids and Palm Trees test raises a question mark over her non-linguistic semantic processing. What could be causing this poor performance? It is certainly not a cultural bias of the test, as the vetted version was piloted with non-brain-injured members of the Bengali community in London, where performance was at ceiling. There is no evidence of a visual or recognition impairment elsewhere, therefore the breakdown must be semantic.

Her oral picture naming in English was not 100% but was comparable to the mean score of the control participants. Once again, all errors (excluding no responses) were semantic errors (e.g. target: lock, response: 'key'; target: goat, response: 'horse'). Her performance on the PALPA naming test elicited more no responses than in the novel tests, but all other errors were again semantic. Rasheda's Bengali oral naming test scores were significantly lower than for the English naming test (McNemar test: $\chi^2 = 9.94$, $df = 1, p = <0.01$). This indicates an impairment when compared to the control group scores. Rasheda again made semantic errors in these tests (e.g. target: /ʃəru:z/ ('sun'), response: /sænd/ ('moon'); target: /u:t/ ('camel'), response: /ʃægɒl/ ('goat')), but also made more no responses than in the English oral naming tests. It is relevant here to acknowledge that Rasheda herself rated her pre-morbid Bengali skills as lower than her English abilities. It is likely that Rasheda learned the target words in both languages before her CVA. Bengali was her L1 – English was not learned until starting school – and she has continued to use Bengali as her home language throughout her life. The test development process sought to establish a body of words that could be easily named by the Bengali community in London, and although her language acquisition history was different to most of the control participants primarily because of her age, she would surely have known words that she failed to name in the Bengali tests (such as 'sun', 'moon', etc.)

Although Rasheda learned to write Bengali at school, she was reluctant to complete the Bengali written naming test as she very rarely wrote in Bengali before or

after her stroke. Of her 5 errors in the English written naming test, 2 were semantic, one semantic-graphemic (target: swan, response: 'segel', i.e. 'seagull'), one graphemic and one no response. The PALPA written naming test indicates a similar performance.

The data indicate that Rasheda's naming performance is not always stable. Indeed, there was not one single item in the novel tests that Rasheda was unable to name at least once in the various languages and modalities tested. This can only indicate that Rasheda retains an intact semantic representation for these items, and that her difficulty must be one of access rather than loss of the representations themselves. It could be the case that the resources available to activate semantic nodes fluctuate. On occasions when sufficient resources were available, the representation received sufficient activation to fire and consequently Rasheda named the target. When the target representation received insufficient activation, competitors also receiving activation increased the chance of Rasheda making a semantic error.

Rasheda's naming in English was significantly higher than in Bengali. Although Bengali is her L1 and continues to be the language of her home environment, Rasheda rated her pre-morbid skills in English more highly than Bengali. One might suggest that her current naming performance reflects her pre-morbid knowledge. However, the data collected from the control participants in the test development process indicate that the targets included in the test are highly likely to be known by members of this community in both English and Bengali. Indeed, her uncle confirmed that it was very likely that she knew all the words included in the tests before her stroke. This raises an anomaly. If semantic processing is central, how can performance in one language be poorer than the other? It is possible that there is a further deficit occurring later in the word production process at the POL level that impacts more on the production of words in Bengali. Rasheda did not make phonological errors at all during oral naming in either language, but this can no longer be taken as evidence of intact phonological processing. Nickels (2004) acknowledges that traditional wisdom associated semantic errors with a breakdown in semantic processing and likewise phonological errors with a phonological deficit. However, she clarifies that the widely used models of word production (such as

those introduced in Section 2.6) actually predict that a deficit at the phonological lexicon level results in the production of semantic rather than phonological errors. If there is insufficient activation flowing through Rasheda's Bengali POL to select the target word, it is possible that the next available competitor is selected and produced. As these competitors are semantically rather than phonologically related to the target (at least based on activation flowing top-down through the system), it follows that such a breakdown would result in the production of a semantic error even though the breakdown has occurred at a post-semantic level.

7.9.5 Azad

Azad	Bengali	English	PALPA
Spoken word to picture matching	30	29	36
Close semantic errors	0	0	1
Distant semantic errors	0	0	1
Visual errors	0	1	1
Unrelated errors	0	0	0
No response	0	0	1
Identified semantic group	0	0	0
Written word to picture matching	30	30	39
Close semantic errors	0	0	1
Distant semantic errors	0	0	0
Visual errors	0	0	0
Unrelated errors	0	0	0
No response	0	0	0
Identified semantic group	0	0	0
Reading aloud	29	29	36
Word repetition	28	29	35
Oral naming 1:			
Uncued	24	26	27
Cross-linguistic cue	1(5)	0(4)	
Phonemic cue	2(3)	3(4)	1(13)
Oral naming 2:			
Uncued	25	23	
Semantic cue	2(5)	1(7)	
Phonemic cue	1(4)	5(6)	
Written naming:			
Uncued	18	15	16
Graphemic cue	2(3)	0	

Table 7.18: Azad's test battery scores.
1. Novel tests include 30 items per test; PALPA includes 40 items per test.
2. Figures in brackets for cueing data indicate total number of cues.

Azad has by far the longest post-onset time of the aphasic participants in the project. His SLT notes, dating back almost 20 years, indicate that his aphasia was initially severe far beyond the acute stage. However, Azad has gradually made a significant recovery, even though he continues to experience a mild residual impairment.

Table 7.18 is a reminder of Azad's scores on the test battery. Azad demonstrated a performance at or close to ceiling in spoken and written word to picture matching in both Bengali and English. This was also largely reflected in the corresponding PALPA tests. Azad's errors in reading aloud were all phonological in nature in both languages, including phoneme additions (target: monkey: /mʌndki:/) deletions (target: bowl, response: /bəʊ/) and substitutions (target: /bʊrɪæŋʊl/ ('thumb'), response: /bɪdænæŋʊl/ (non-word) which resulted in the production of both real and non-word errors. Word repetition errors mirrored this profile.

Azad's score on the Pyramids and Palm Trees Test was also quite high, but as he failed to answer 8 items correctly, his score is somewhat lower than the ceiling performance collected from the controls without brain injury during piloting.

Azad's performance on the oral naming tests in Bengali indicates a mild impairment. Most errors were semantic (target: /æŋu:r/ ('grapes'), response: /fʊlxɒbi:/ ('cauliflower' - potentially a visual-semantic error), although Azad also made a small number of code-switching errors during testing in both languages. Oral naming in English was also mildly impaired, but error types were more varied than in Bengali. Whereas Azad's naming errors in Bengali were predominately semantic, errors in English included semantic (target: swan, response: 'goose'), code-switching, and phonological errors (target: prawn, response: 'kingfisher', i.e. targeting 'king prawn' – possibly a semantic-phonological error). Azad made more errors on the PALPA naming. In this test, errors were mostly semantic (target: belt, response: 'lock'), but also phonological (target: anchor, response: 'anvil') in nature.

Analysis of Azad's spoken naming test errors does not yield a clear locus of naming breakdown. He made a small number of semantic errors in all naming tests, but these semantic errors made up a high proportion of his total errors. It is possible to infer from the scores for the word to picture matching tests and the Pyramids and Palm Trees test that Azad's semantic system is largely intact. Consequently, Azad's semantic errors are more likely to result from a breakdown in the connections between lexical semantics and the POL. However, there is also some evidence of breakdown at a phonological level

in both languages. Azad made errors of both phoneme and syllable addition, substitution and deletion in the word repetition tests and reading aloud tests, most of which result in a non-word in both the target and non-target languages. These data are insufficient to differentiate between a breakdown in lexical versus non-lexical routes to production, but either way, the breakdown could occur during phonological encoding. Azad did not make phonological errors in the novel picture naming tasks in either language, although he did make a small number of phonological errors in the PALPA naming test. If the POL is compromised, it is fair to argue that this is a mild disruption. Cross-linguistic comparison of the naming tests reveals no significant difference in the data; therefore Azad's difficulties appear to be largely balanced. Likewise, Azad made a few code-switching errors in both languages, so it is evidently not the case that one language consistently becomes inhibited as the lexical equivalent in the non-target language becomes available.

Written expression is clearly Azad's most impaired modality. This difficulty impedes his ability to write in both Bengali and English – his novel written naming scores in both languages, as well as for the PALPA equivalent, were by far his lowest scores in the battery. He did make some semantic errors in written naming, but graphemic errors were by far the most numerous. Azad's errors in both Bengali and English written naming followed a similar pattern. He was often clearly targeting the correct item, but was unable to fully access the graphemic form, and he often tried to improvise by inserting characters that provided an approximation of the spoken form. For example, for the target word তালা (/tɑ:lɑ/, 'lock'), Azad wrote থালা (/t^{h}ɑ:lɑ/, a non-word). Although Azad's response might be considered a phonetic approximation of the target, he would never have seen this presented as a correct word form. Errors included the substitution (target: umbrella, response: 'umblela'; target: ব্যা (/beŋ/, 'frog'), response: বেঙ /beŋ/ (a non-word homophone), addition (target: teeth, response: teenth) and deletion (target: elephant, response: elephen) of graphemes. Azad was able to identify whether his attempt at writing a word was incorrect, but he was unable to suggest which part of the word was wrong. Azad's errors on the PALPA were similar to those made on the novel writing tests. He

made a similar number of semantic errors in both languages to those on the spoken naming tests (although semantic errors in the written test form a lower proportion of total errors than in the oral naming tests). One could suggest that it is unsurprising that Azad made a similar number of semantic errors in both expressive modalities, as the semantic system is purported to be central for both modalities. That is, semantic errors arise in written naming because of accessing the same semantic module used for spoken naming. Most of Azad's written errors appear to originate in the orthographic output lexicon. He appears to have either partial access to the orthographic form of the target or is unable to retain the full orthographic form of the word for most errors. He often wrote down as much of the target as he could access; after checking what he had written, he tended to 'fill in the gaps' with what he considered to be appropriate graphemes. This is typical of breakdowns associated with the Orthographic Output Buffer (analogous to the Phonological Output Buffer in spoken word production, see Section 2.6).

7.9.6 Asha

Asha has made a positive but not total recovery from her CVA. She also has a residual language impairment and a history of word finding difficulties since her stroke. The difficulties still pervade her spontaneous speech, but it is clear from her scores on the test battery that the tests are insufficiently sensitive to highlight her difficulties. Indeed, Asha found completing the tests patently silly and became somewhat impatient. Although she was entirely willing to participate, it quickly became clear that exploration of her difficulties was beyond the scope of both the tests and the current study.

Table 7.19 is a reminder of Asha's scores on the test battery. Her score on the Pyramids and Palm Trees test, although slightly lower than the scores of the controls, is not low enough to indicate a semantic impairment.

Asha's performance profile is close to ceiling in most modalities. The one area where her scores were somewhat lower was for oral naming in Bengali. Her English naming scores were within one standard deviation of the mean of the control participants. Her Bengali naming scores were lower, but even then were within two standard deviations of the mean. Asha made more semantic errors than any other type of error, but

in truth the tests are simply not sensitive enough to point towards where Asha's word finding might be breaking down.

Asha	Bengali	English	PALPA
Spoken word to picture matching	29	29	37
Close semantic errors	1	1	3
Distant semantic errors	0	0	0
Visual errors	0	0	0
Unrelated errors	0	0	0
No response	0	0	0
Identified semantic group	0	0	0
Written word to picture matching	29	29	38
Close semantic errors	1	1	2
Distant semantic errors	0	0	0
Visual errors	0	0	0
Unrelated errors	0	0	0
No response	0	0	0
Identified semantic group	0	0	0
Reading aloud	30	30	40
Word repetition	30	30	40
Oral naming 1:			
Uncued	25	27	35
Cross-linguistic cue	0(5)	0(3)	
Phonemic cue	0(5)	0(3)	0(5)
Oral naming 2:			
Uncued	26	27	
Semantic cue	0(4)	0(3)	
Phonemic cue	0(4)	0(3)	
Written naming:			
Uncued	28	29	34
Graphemic cue	0	0(0)	

Table 7.19: Asha's test battery scores.
1. Novel tests include 30 items per test; PALPA includes 40 items per test.
2. Figures in brackets for cueing data indicate total number of cues.

7.9.7 Effects of cueing on picture naming

Table 7.20 presents a summary of the aphasic group's responses to cueing in the naming tests. There is little in the data to suggest that cross-linguistic or semantic cues were useful for any of the aphasic participants. Phonemic cues were by far the most successful type of cue. Furthermore, phonemic cues facilitated more correct responses in English than Bengali. Only one aphasic participant demonstrated a significantly different effect of cueing across languages. Saleha was more responsive to cues in English than Bengali (that is, all cues in English versus all cues in Bengali; Chi square test: $\chi^2 = 6.558$, $df = 1$, $p<=0.01$).

	Total cues	Total successful	%
Cross-linguistic cue			
English	78	5	6.41%
Bengali	83	3	3.61%
Semantic cue			
English	86	7	8.14%
Bengali	79	6	7.60%
Phonemic cue			
English	167	75	44.91%
Bengali	154	40	25.97%
PALPA	133	56	42.11%

Table 7.20: Summary of cueing effects on picture naming for all aphasic participants.
1. The language for the cross-linguistic data is the target language, i.e. "Cross-linguistic cues: English" indicates that English was the target language and the cue was provided in Bengali.

Finally, a word of explanation is necessary to account for what appears to be an error in the data for cross-linguistic cueing in the oral naming tests. The methodology for administering the naming tests anticipated that participants would be given a cross-linguistic cue for all items that they failed to name. In theory this means that if a participant named 15 of the 30 items without a cue, s/he would then be cued for the remaining 15 items. Although the figures agree for the semantic cueing data, this is not always the case for the cross-linguistic cueing data (e.g. Table 7.4: Salma). This is because the participants occasionally anticipated the cross-linguistic cue by making a code-switching error (i.e. they produced the cue). When this happened, the tester asked if the participant knew the word in the target language. If this elicited no further response, a phonemic cue was provided. These data will be interpreted in Section 7.10.3.4.

7.10 Discussion

This section will explore various aspects of the assessment data, evaluate the process of carrying out this stage of the project, and suggest hypotheses drawing on the assessment data and models of bilingual language processing regarding how participants might respond to word finding therapy.

7.10.1 On recruitment

The target number of aphasic participants for the project was 20. After a great deal of effort, a total of six people who satisfied the participation criteria were recruited.

Given that over a third of the population of Tower Hamlets consists of people from Bangladesh, why was recruiting so difficult? Given the prevalence of stroke and the increased vulnerability to stroke of people from South Asia in the UK (Joint Health Surveys Unit, 2001), there must be more aphasic people in London's Bengali community than were identified. Part of the difficulty was that the number of suitable participants on the caseloads (both current and discharged) within SLT departments in NHS Trusts covered by the ethical committee was far lower than anticipated. One might question whether SLT departments receive sufficient referrals for patients from ethnic minority communities with aphasia at the acute stage. It could be that language impairments are not identified in L1 speakers of a minority language. Indeed, in their survey of SLT managers in the UK, Marshall, Atkinson, Thacker & Woll (2003) provide evidence to support the suggestion that L1 speakers of minority languages in the UK are not fully accessing SLT services.

Another difficulty was that Bengali patients were referred to SLT departments primarily for dysphagia. Consequently, SLT notes did not always refer to the presence of aphasia or of carrying out assessments to reject the possibility. Additionally, SLT notes also failed to provide details of bilingualism. Granted, the notes often identified when assessment (again, largely for dysphagia) had been carried out in Bengali through collaboration with a coworker, but collection of details of bilingualism and pre-morbid English use were rarely available. Contacting the families of discharged patients to establish the potential presence of bilingualism and aphasia was not productive and was occasionally distressing where patients had since died. Although a higher number of aphasic participants would have been preferable, the six aphasic people that were recruited can still inform this exploration. Indeed, the scope of the study was widened to account for the lower number of participants than anticipated. This primarily impacted on the amount and format of therapy each aphasic participant received (this will be outlined in the following chapter).

In the early stages of the project, before the process of recruiting aphasic participants had been initiated, a number of Bengali contacts (such as bilingual coworkers

and staff at Bengali community associations) suggested that only elderly men would be willing to take part in the project. This was largely because they thought only older people have strokes, and that most females would be too inhibited to participate, especially given the gender of the researcher. In fact, most aphasic participants were neither old nor male. Only one participant was over 60 years old, and the mean age of the group was 46;1 years. Likewise, four of the six participants were female, therefore in contrast to an elderly male group, a young, predominantly female group was recruited. It is relevant to ask why the group was so different to the one anticipated. Although people from a South Asian background are vulnerable to stroke at an early age, one might still have expected to find more older participants. Given the migration history of his community, it seems likely that it is the bilingualism variable that resulted in such a young group of participants. Many elderly Bengali people are likely to have been first generation migrants and may not have learnt English as an L2 beyond the level of minimal bilingualism (although in truth the search for participants did not unearth a great number of people matching this profile). Likewise, it is likely that younger people had more opportunities or inclination to learn English (either at school in Bangladesh, where English lessons have become more widespread over the last 50 years) or in the UK.

7.10.2 Cultural considerations

It was not a goal of the current study to establish how suitable the PALPA tests are when working with people from the Bengali community. The PALPA does not claim to be suitable for working with this population, therefore criticism for its cultural inappropriateness would not be justified. In fact, the data collected from the PALPA stand up remarkably well in comparison to the equivalent novel test scores in English. A great deal of attention has been given to the test development process of the current study, yet in fact the PALPA data are not significantly different. The novel test scores in English are generally a little higher than the PALPA due to the latter's inclusion of a small number of items (e.g. bread, stirrup) that were consistently difficult for the participants.

As the test development process was carried out in collaboration with the project consultant, bilingual coworkers, and the non-brain damaged control participants, it was

established (as far as was possible) that the tests developed as part of this project were not culturally biased for the target community. The one aspect of the initial plan that had to be modified was the recording of assessment sessions. It was the intention to record all aphasic participants' performances on the production tasks to avoid relying on real time transcription. However, the majority of the aphasic participants did not give their consent for recording (neither audio nor video) the sessions. This was something that the project's Bengali advisers had not anticipated. Perhaps participants thought that the tapes might be used without their knowledge and they feared ridicule or were embarrassed about their difficulties. Although the researcher explained the reason for asking permission to record the sessions, the participants' wishes were, of course, respected. Consequently, the need for accurate transcription and recording of responses was unavoidably increased.

It is also pertinent to discuss the apparent complete reading failure in the native language of two of the six participants. Clearly, if a person was not literate in a language premorbidly (e.g. Tarik was never able to read English), it was not relevant or informative to carry out tests in that language. However, both Salma and Saleha were completely unable to complete tests with a written stimulus or requiring a written response. A complete reading failure in a person with aphasia would be unusual, but that occurrence in two participants from a group of six appears to be an unlikely coincidence. Could the participants' failure on these tests be attributed to their cultural background? It is possible that Salma and Saleha overrated their pre-morbid literacy levels. This however, does not seem to be the case, as the self-ratings of both participants matched with their reported language acquisition history. Both participants attended school in Bangladesh as children where Bengali was the language of education and Bengali literacy was taught from the outset. Saleha also rated her pre-morbid English level as 'not good'. In addition to matching her reported language history (she did not move to the UK until adulthood), it also indicates that she does not have a tendency to overrate her languages. She rated her English literacy as low because it *was* low; one can therefore be fairly confident in her higher self-rating of Bengali literacy. Salma rated her literacy in both languages as 'good'. Again, this matches her reported language history. She learned some Bengali

writing in school as a child, but as she moved to the UK as a child, she also learned enough English literacy to complete 'O' levels at age sixteen. Both Saleha and Salma read in Bengali at least weekly before their CVAs, so one can be fairly certain their Bengali literacy had not been lost due to underuse.

It is feasible to suggest that the cultural background of these participants influenced their performance on these tests. I am not suggesting that either participant 'pretended' not to be able to complete the tests when they could, more that they knew that reading was a difficulty for them since their CVAs, and they chose to opt out of the tests rather than persevere. Given that the occurrence of two complete reading failures in a group of six participants seems unlikely, and that both Salma's and Saleha's self-rating appear to be consistent with their language acquisition history, attributing this failure to their cultural background appears justifiable. The idea of illness and infirmity conferring elder status was raised in Section 5.8.7. It may also be a gender-specific factor, as both Tarik and Azad also presented with impaired reading abilities, but were willing to carry out reading tests despite their frequent mistakes. As an outsider to Bengali culture, it is difficult for the researcher to deduce too much after learning a little about an unfamiliar culture. Indeed, discussions with both male and female members of the bilingual coworker group did not result in any suggestions as to why culture rather than impairment might be contributing to these zero scores. However, given the absence of other reasons for this pattern of performance, it is reasonable to at least raise the possibility that cultural considerations influenced performances on some tests for some participants.

7.10.3 Assessment data

Data from the assessment battery have been discussed for each participant on an individual basis. There are, however, elements of the assessment that are appropriate to be considered at a group level.

The data indicate that the naming tests are reliable, as the two administrations of the tests in each language are highly correlated. However, the small aphasic group size and the fact that two aphasic participants performed close to ceiling and another two close

to floor means that the data must be approached with caution. Clearly it would be beneficial to collect data from a larger number of aphasic people.

The two administrations of the test in each language are highly correlated. Furthermore, with the exception of Tarik's English naming scores, the participants' test scores for the two administrations were broadly similar. Consequently, the correlation arises not because the participants scored consistently higher in the second administration of the test. One can therefore reject the possibility that the cueing of the first administration of the tests (each unnamed item potentially received two cues) significantly effected uncued naming during the second administration of the test, even if it facilitated an immediate production of a target.

7.10.3.1 Cross-language differences

Despite the relatively high number of tests carried out in the assessment battery, there were few instances where participants performed significantly differently in the two test languages. Three of the six participants (Rasheda, Salma, and Tarik) indicated a significant difference between naming in Bengali and English. It is also notable that not all these participants demonstrated a differential impairment in the same direction. That is, the result can not just be due to a bias of the test itself. However, for all three participants who performed differently across the two languages, the stronger language was always the one that each participant had self-rated as being their strongest pre-morbidly. Consequently, it is difficult to argue that these results indicate a differential impairment rather than reflecting pre-morbid skills.

Where cross-language differences in test scores did occur, these differences were in line with the participants' self-ratings of pre-morbid ability. That is, regardless of the stronger language being L1 or L2, where testing in one language resulted in a significantly higher score than in the equivalent test in the other language, each participant had self-rated the stronger language as being pre-morbidly stronger as well. Consequently, although data indicating some differential test scores across languages have been acquired, it is difficult to argue that these differences indicate differential impairments as opposed to simply reflecting pre-morbid abilities, regardless of the steps

that were taken to ensure that the tests were of largely equal difficulty in the two test languages.

7.10.3.2 Semantic errors (input and output)

All participants made semantic errors during the tests to some extent. This does not, however, indicate that all participants present with impaired semantic processing. The production of semantic errors in a naming test does not necessarily indicate a semantic impairment (Kay & Ellis, 1987; Lambon Ralph, Sage, & Roberts, 2000). It is also difficult to argue confidently that a participant presents with a semantic impairment based on the relatively limited data acquired from the test battery from the current study. From the individual discussion of participants' assessment profiles above (sections 7.4.1-6), Rasheda and Salma stand out as the two participants whose semantic processing may be compromised. If a participant made semantic errors on both input and output tests, this would be a much stronger indication of a semantic impairment than the production of semantic errors in a naming test. Furthermore, it may be misleading to infer a semantic impairment simply by identifying that a participant makes a high number of semantic errors. It is more informative to calculate the proportion of semantic errors a participant made in proportion to his or her total errors. For example, in the initial test data, Tarik made semantic errors on both input and (especially on) output tests. These data alone are insufficient to indicate a breakdown of semantic processing; it is also necessary to explore if those semantic errors make up the majority of Tarik's errors, or are they one aspect of what is in fact a broad range of errors? If a participant makes a number of semantic errors on both input and output tests and those errors make up a high proportion of total errors in each language, this would be a stronger indication of a semantic impairment.

Table 7.21 collates the semantic errors (data already reported in Section 7.9) made by all participants throughout the test battery in Bengali and English and compares these to the total number of errors made (these data were already presented in the results section but are collated together here to facilitate comparison). As some participants failed to score on some tests involving literacy (see Section 7.10.2), a proportion of errors on tests not requiring literacy has also been calculated, as the high number of 'no

responses' on these tests might have resulted in a misleadingly low proportion of semantic errors for some participants. Although this extra perspective on the semantic errors made by the participants does add more scope to the data, it is especially important to exercise caution as proportions or percentages can be misleading when taken out of context. For example, Asha's proportion of semantic errors to total errors is one of the highest of the group in both languages. This does not, however, add strength to any argument that she has a semantic impairment. Asha presented with the mildest aphasia of the group and consequently made few errors. Table 7.21 indicates that Asha's proportion of semantic errors was very high but sometimes this proportion is based on just one error (i.e. one semantic error out of one total error results in a proportion of 1). On no account can this be justification of a semantic impairment.

Despite the need for caution, this calculation does help to clarify and differentiate participants' assessment profiles. Both Rasheda and Salma made semantic errors on input and output tests in the battery, but their proportions of semantic errors compared to total errors are strikingly different. Salma's proportion of semantic errors to total errors is in fact low in both languages. She made semantic errors but she also made many other errors as well. Rasheda's proportion of semantic errors is much higher all round. However, it is difficult to reach conclusions based on such small numbers. Suffice to say, of the six participants assessed, Rasheda is the most likely to have compromised semantics, but it is not possible to be confident based on these data. Indeed, if Rasheda's deficit was purely semantic, one might expect a similar proportion of semantic output errors in both languages, but this was not the case. Although she made a similar number of semantic output errors in Bengali and English, her proportion of semantic errors was much lower in Bengali than English. This lower proportion might reflect her potentially less wide pre-morbid vocabulary in Bengali (discussed in Section 7.9.4).

Saleha's proportion of semantic errors is also noteworthy. She made a high proportion of semantic input errors in both Bengali and English. Her low proportion of output errors in both languages reflects her severely impaired word production rather than a low proportion of semantic errors. She found it very difficult to produce any words in

the output tests; therefore most of her attempts at word retrieval were coded as 'no response'. Given her low score on the Pyramids and Palm Trees test, Saleha may also be experiencing difficulties at the semantic level.

	Saleha	Salma	Tarik	Rasheda	Azad	Asha
Bengali						
Input errors:						
Spoken word to picture matching:						
Close semantic	4	1	2	0	0	1
Distant semantic	1	0	2	1	0	0
Combined semantic errors (total errors)	5(8)	1(9)	4(4)	1 (1)	0(0)	1(1)
Written word to picture matching:						
Close semantic	-	-	1	1	0	1
Distant semantic	-	-	1	1	0	0
Combined semantic errors (total errors)	-	-	2 (11)	2 (3)	0(0)	1(1)
Proportion - total semantic input errors/total input errors	-	-	0.40	0.75	0.00	1.00
Proportion - total semantic input errors/total input errors (excluding tests requiring written input or output)	0.63	0.11	1.00	1.00	0.00	1.00
Output errors:						
Oral naming 1(total errors):	2(28)	1(23)	3(12)	4(11)	2(6)	3(5)
Oral naming 2(total errors):	2(29)	5(20)	5(14)	3(7)	3(5)	3(4)
Written naming (total errors):	-	-	-	NA	2(12)	1(2)
Word repetition (total errors):	0(0)	0(2)	0(2)	0(0)	0(2)	0(0)
Reading aloud (total errors):	-	-	0(10)	0(1)	0(1)	0(0)
Proportion - total semantic output errors/total output errors	-	-	0.21	0.37	0.27	0.64
Proportion - total semantic output errors/total output errors (excluding tests requiring written input or output)	0.07	0.13	0.29	0.39	0.38	0.67
English						
Input errors:						
Spoken word to picture matching:						
Close semantic	7	1	3	1	0	1
Distant semantic	3	0	2	1	0	0
Combined semantic errors (total errors)	10(12)	1(17)	5(8)	2(2)	0(1)	1(1)
Written word to picture matching:						
Close semantic	-	-	NA	0	0	1
Distant semantic	-	-	NA	0	0	0
Combined semantic errors (total errors)	-	-	NA	0(0)	0(0)	1(1)
Proportion - total semantic input errors/total input errors	-	-	0.63	1.00	0.00	1.00
Proportion - total semantic input errors/total input errors (excluding tests requiring written input or output)	0.83	0.06	0.63	1.00	0.00	1.00
Output errors:						
Oral naming 1(total errors):	0(29)	0(29)	3(25)	3(3)	2(4)	1(3)
Oral naming 2(total errors):	0(30)	0(27)	1(16)	3(3)	2(7)	1(3)
Written naming (total errors):	-	-	NA	2(5)	3(15)	0(1)
Word repetition (total errors):	0(13)	0(7)	0(6)	0(0)	0(1)	0(0)
Reading aloud (total errors):	-	-	NA	0(0)	0(1)	0(0)
Proportion - total semantic output errors/total output errors	-	-	0.09	0.73	0.25	0.29
Proportion - total semantic output errors/total output errors (excluding tests requiring written input or output)	0.00	0.00	0.09	1.00	0.33	0.33

Table 7.21: Collated input and output semantic errors for aphasic participants.

7.10.3.3 Interpretation of responses to cueing

Phonemic cues were by far the most successful type of cue in both languages. It is clear that neither semantic cues nor cross-linguistic cues were useful for any of the aphasic participants. That semantic cues rarely facilitate picture naming is consistent with the studies of cueing with unilingual participants (Section 2.8.1). It is appropriate to consider whether these data can help identify where breakdown in the language processing system might occur. For some aphasic participants in the study, there was some evidence for a breakdown in semantic processing. Indeed, all participants made some semantic errors in picture naming, although Section 2.7.3 established that this does not necessarily indicate a semantic impairment. If the semantic module is unable to output sufficient activation following the input of the picture stimulus, one might anticipate that an additional semantic cue might produce an extra surge of activation that allows the target to be produced. This, however, is clearly not the case. It is possible that a descriptive semantic cue often only provides information that the picture stimulus has already provided, assuming that picture recognition is intact. With hindsight, it would have been potentially interesting to explore whether related rather than descriptive semantic cues have a different effect on the facilitation of picture naming (the different types of semantic cues that have been used in aphasia research were outlined in Section 2.8.1). A related cue might have provided extra activation as it may have activated an additional semantic connection not activated by the initial picture stimulus.

The semantic cues were established in advance of testing through collaboration with a coworker. The focus was on providing descriptive information that would be culturally relevant. Following discussion (in English) with a bilingual coworker, cues were then translated into Bengali. No attention was given to grammatical complexity of the translation – the emphasis was on ensuring that a semantic cue provided the same amount of semantic information in each language.

Cross-linguistic cues were not very useful for any of the aphasic participants either. This is somewhat surprising, as one might consider providing the lexical equivalent of the target in the non-target language to be a highly facilitative cue simply

because it must greatly reduce the number of items competing for activation. This would only be the case, though, if there were direct connections between lexicons as set out in the SOPHIA model (Section 3.7). Indeed, Marshall, Atkinson, Woll & Thacker (2005) have argued for the existence of such connections based on case study data of a bilingual English-British Sign Language user with aphasia, who was responsive to cross-linguistic cues. However, as cross-linguistic cues did not facilitate word retrieval, the data from the current study provide fairly strong evidence against such connections. As Green's (1986) bilingual serial model has no direct connections between lexicons, it can account for cross-linguistic cues having little effect on picture naming. The only route for translation is through the semantic module. This means that a cross-linguistic cue might not actually provide any more activation to semantics than a semantic cue. If an aphasic participant recognises the picture, the semantic module must have been sufficiently activated to facilitate understanding. In the same way that a semantic cue might not provide more activation to semantics, it is possible that a cross-linguistic cue does not provide any more useful information. Indeed, it could even be inhibitory. If the semantic output was insufficient to activate an item from an output lexicon, a cross-linguistic cue might not have any impact on resources or activation available for the semantic output. As activation flows through both languages in the bilingual interactive model, it predicts that a cross-linguistic cue provides extra activation to the target. Obviously this can break down in aphasia – connections can be severed or damaged, resources available for the activation process can be greatly reduced or control of that activation compromised. It is striking, however, how few cross-linguistic cues were successful for all the aphasic participants. The interactive model also predicts that activated phonological nodes will feedback activation to lexical nodes. This predicts that a cross-linguistic cue will activate the phonemes contained in that cue even if the cue has been unable to successfully activate the target. Those activated phonological nodes will also feedback through the target language (i.e. not the language of the cue). If the cue shares phonemes with the target, this might also have a facilitative effect. However, as cognates were excluded from

the study, cross-linguistic cues shared few phonemes with targets; therefore they could not have provided much activation via phonological nodes.

Phonemic cues clearly had a much stronger effect than the other cues. The phonemic cueing effect becomes even more compelling when one considers that aphasic participants only received a phonemic cue for items that they had failed to name following either a semantic or cross-linguistic cue (at least, in the novel naming tests). This effect is unsurprising, as it replicates findings in several studies of unilingual picture naming (Section 2.8.1). Indeed, regardless of which processing model one explores, a phonemic cue greatly reduces the number of items competing for production. If activation of the target is weak, reducing competition to items with a known word-initial phoneme has a powerful effect. It is surprising to find that phonemic cues were far more successful for cueing naming in English than in Bengali.

Saleha was the only participant to demonstrate a differential ability to respond to cues. As she performed at floor in the naming tests, this might also be used as an indication of a differential impairment, especially given that she was more responsive to cues in her L2. The researcher is unfamiliar with any studies that have used cueing data to suggest a differential impairment in the absence of meaningful data from other tests, but if a patient is more responsive to cues in one language, this might be taken as a signifier of potential response to therapy and could contribute to the decision-making process when considering which language to initially treat. Saleha's response to cueing is puzzling. She was significantly better at producing words in English in response to cues than in Bengali, yet she was significantly better at repeating words in Bengali than in English. It is difficult to account for this uneven profile.

Even if Salma's data are removed from the group, there is still a trend towards word production being more successfully facilitated by a phonemic cue in English than in Bengali (48.15% and 31.96% respectively). Clearly, one must approach these data with caution, as one participant (Asha) was entirely unresponsive to cueing in either language. This makes what was an already small group number even smaller. As English was the L2 for all aphasic participants, how might one account for L2 being more cueable than

L1? It might be the case that (prior to any SLT treatment) bilinguals with aphasia have a reduced potential to produce words in their lexicon. Access to some of these words (in both languages) may have been compromised so much that, regardless of cueing, they will not become available for production short of having the word made available for repetition. This access difficulty may be because the lexical representation is destroyed or because the activation required to facilitate production of these words is so insufficient that a cue still does not increase activation to the level where retrieval can be completed. For the rest of the bilingual lexicon that does have the potential to be produced, perhaps words in the L1 lexicon require less activation to facilitate production (due to higher resting levels). Consequently, these words are more likely to be produced without the need for a cue. It is possible that L2 words that have the potential to be produced require more activation for production than some L1 words. This tentative suggestion might at least begin to account for Saleha's uneven naming performance.

7.10.4 Hypotheses for outcomes of word finding therapy

When outlining hypotheses regarding how the aphasic participants might respond to SLT targeting word finding difficulties, it is necessary to begin by stating an assumption regarding how different types of treatment activates different levels of the language processing. Section 2.8 acknowledged Howard's (2000) suggestion that semantic and phonological therapy in fact do more or less the same thing, namely generally activate the language processing system. However, Section 2.8 (particularly Section 2.8.3) discussed a number of studies that report different outcomes following semantic and phonological therapy. The assumption is therefore made that semantic therapy primarily activates semantic representations and likewise phonological therapy primarily activates phonological representations (although both types of treatment are likely to activate both semantic and phonological representations, at least to some extent).

Section 3.6 outlined the growing evidence for shared semantic representations in bilingual language processing. Indeed, all of the models of bilingual language processing discussed in this study allow for shared semantic representations. If semantic processing is shared, this predicts that any gains in the treated language following semantic therapy

(activating a shared semantic representation) would result in cross-linguistic generalisation to equivalent items in untreated language. Section 4.7.4 offered initial findings from Edmonds & Kiran (2006) that demonstrated exactly this.

Although the models of bilingual language processing discussed in this study are largely consistent on the issue of shared semantic processing, different models predict different outcomes regarding cross-linguistic generalisation following phonological therapy. Lexicons in Costa *et al.*'s (2000) model (Section 3.6) are distinct and connected via semantics rather than inter-lexicon connections. This predicts that activating a phonological representation in one language will not necessarily result in activating the equivalent representation in the untreated language (with cascading activation, equivalent phonological representations in the other language are likely to receive some activation, but will be activated much less than the activated target language representation unless they are cognates, i.e. sharing phonological features). Conversely, the SOPHIA model (Van Heuven & Dijkstra, 2003) offers a single integrated lexicon for bilinguals. In this model, phonological representations for equivalent items are directly connected at the phonological level as well as via semantics. Consequently, the SOPHIA model suggests that activating phonological representations in one language during phonological therapy should also activate the phonological representations in the non-treated language; therefore gains in treated items should also generalise to equivalent items in the untreated language. However, the data from cross-linguistic cues in the current study did not provide evidence to support this hypothesis (see above Section 7.9.3).

Hypotheses can be raised regarding how each aphasic participant might respond to therapy. As acknowledged in Section 2.7, aphasic impairments can not always (or in my experience, often) be reliably pinpointed to affecting a single level of language processing. However, several clinicians and researchers (e.g. Nettleton and Lesser, 1991, and Miceli *et al.*, 1996) have advocated treating what appears to be a breakdown at the semantic level with semantic therapy and likewise phonological impairments with phonological therapy. The nature of aphasic impairment of each participant has been discussed in this chapter; therefore it is possible to raise some tentative hypotheses

regarding how they might respond to therapy. Of the six aphasic participants who took part in the assessment phase of the project, only five progressed to the therapy phase. By mutual agreement, Asha did not receive the SLT offered by the project. Her performance in the assessment in both Bengali and English was at or close to ceiling; she also became quite impatient, as she found the tests rather easy. It was agreed that although Asha experiences occasional word finding difficulties in spontaneous speech, these were beyond the scope of the treatment offered which targeted single word production. She does, however, continue to attend a local conversation group for aphasic people carried out in English.

7.10.4.1 Predictions for outcomes of treatment for Saleha

Saleha has severe word finding difficulties. Section 7.9.1 reported and discussed indicated evidence that suggests impairments to both semantic and phonological processing. It may be the case that Saleha's difficulties are so severe that she will not respond to treatment. However, activating semantic representations of the target words may result in improved naming of those items. It is also clear that Saleha's phonological processing is compromised in both languages. However, there is a differential profile here: Bengali phonological processing appears to be less impaired than English (word repetition is much better in Bengali), but Saleha is more responsive to phonemic cues in English. This is exactly the type of activity that is carried out during phonological therapy, so if Saleha responds well to phonemic cues in English (but not so much in Bengali), it is possible that phonological therapy will have a more positive outcome following treatment in English.

7.10.4.2 Predictions for outcomes of treatment for Salma

In a similar way to Saleha's, Salma's assessment profile indicates severe anomia with evidence of both semantic and phonological breakdown (see Section 7.9.2). It may be the case that her aphasia is so severe that she has limited scope for change following therapy. Semantic therapy may increase activation to semantic representations, but it is also clear that if a target semantic representation is activated, Salma still often experiences lexical access difficulties. Salma word naming and word-picture matching

was significantly better in Bengali; therefore if Bengali is the more spared language of the two, it may have more potential to respond to treatment. However, Salma responded to more phonemic cues in English than Bengali; therefore one might anticipate that if she was going to respond at all to therapy tasks, English phonological therapy offers the most scope for gains from treatment.

7.10.4.3 Predictions for outcomes of treatment for Tarik

Section 7.9.3 outlined concerns that Tarik may be spontaneously recovering from his stroke. If this is the case, one would anticipate generalised improvements to both treated and untreated control items during the therapy phase.

7.10.4.4 Predictions for outcomes of treatment for Rasheda

Rasheda is by far the youngest participant in the study and therefore may have the greatest potential to respond to therapy, especially she continues to use both languages to communicate on a daily basis. Her assessment profile (discussed in Section 7.9.4) suggested that phonological processing appeared to be intact in both languages and that where errors occur, it is likely to be as a result of a breakdown in semantics. Activating semantic representations may result in improved naming, but it may equally be the case that as Rasheda continues to be an active and largely fluent user of both languages, there may be sufficient activation cascading through the language processing system following activation of either semantic or phonological representations that either may result in improved naming.

7.10.4.5 Predictions for outcomes of treatment for Azad

Azad has by far the longest post-onset tome of the participants. Although his SLT notes indicate that he once had a severe aphasic impairment (indeed, evidently as severe as Saleha), he has made a significant recovery over a period of 20 years and now experiences a mild residual impairment. Azad's aphasia is certainly stable, therefore any improvements to naming can reliably be attributed to therapy, but it is possible that after such a long post-onset period he has already made the recovery he is going to. Azad's assessment profile (discussed in Section 7.9.5) indicated that semantic processing appeared to be intact and that errors were occurring at phonological and buffering levels.

Consequently, one might predict that activating phonological representations may facilitate naming of treated items more so that activating semantic representations. However, similarly to Rasheda, as Azad remains an active daily user of both languages, activating representations at either level may result in increased cascading activation through his language processing system.

7.11 Summary and review

Over the course of this chapter, the process of carrying out an assessment of word finding difficulties with bilingual participants with aphasia has been reported. The steps taken to recruit a group of suitable aphasic participants have been reported and the difficulties encountered during the recruitment process have been discussed. Each aphasic participant has been profiled. This has included a review of their language acquisition history and pre-morbid language use. The performance of each participant was reported and has been discussed and hypotheses regarding how they might respond to treatment have been raised. Given the difficulty of predicting outcomes of therapy, it is appropriate to acknowledge that these predictions regarding therapy outcomes are unlikely to be proved correct, especially given the relatively limited assessment data available for each participant. Consequently, data (for therapy outcomes) for each participant presented in the following Chapter will continue to be presented in the order of severity of naming impairment as it was in the current Chapter.

The assessment scores of three of the six aphasic participants produced cross-language differences in some tests. It is reassuring that differential scores were found in both directions in the tests. That is, as evidence exists demonstrating a greater impairment for some participants in both Bengali and English, the differences cannot simply be a bias of the tests, where the targets in one language might be more difficult than the other. Both the serial and interactive bilingual language processing models have proven useful as providing structures which can be used to suggest loci of language breakdown. None of the models can account for all the difficulties encountered by the aphasic participants.

In one respect, this assessment of bilingual aphasia is inadequate. Paradis (1995b) makes it clear that a systematic assessment of all the languages spoken by an aphasic

client is essential to gain a full profile of a bilingual language disorder. Culturally relevant tests of Bengali and English have been developed through the project, but assessments of Arabic, German, Hindi, Punjabi, and Urdu would also have to have been carried out to satisfy Paradis' demand. In one sense, a full profile of a language disorder for all the participants who speak other languages in addition to Bengali and English has not been acquired. However, there are factors to defend the decision to assess only Bengali and English. In order to be able to carry out reliable assessments of Bengali, bilingual coworkers were employed and trained. It was certainly beyond the scope of this project to employ and train coworkers who spoke other languages, although clinicians may well have access to a range of bilingual professionals. Likewise, involving families in the assessment of these other languages might not have been useful, as languages spoken by the participants were not always spoken by spouses or their families. One might also question how reliable data collected through collaboration with family members would be, and whether or not these data can be compared directly to those collected through bilingual coworkers or a SLT. Additionally, there is also the issue of acquiring appropriate assessment materials for these languages. Certainly, aphasia tests are not available for all the additional languages spoken by the aphasic group. Indeed, for those languages where aphasia tests are available, there are no normalised data to indicate how people from a Bengali culture would perform. One could also question how useful an assessment of these additional languages would be to the participants themselves. Bengali was the language used at home for all participants; English was the environmentally dominant language. None of the participants reported post-onset use of any other languages beyond Arabic for religious purposes.

All of the aphasic participants in this study experienced word finding difficulties in spontaneous speech. However, the tests in the battery were not always sensitive enough to illustrate the real problems. Two aphasic participants performed close to ceiling on the battery in both languages, yet both continued to experience word finding difficulties. Clearly, developing a reliable test of picture naming suitable for Bengali is a useful contribution, especially given the paucity of research with aphasic people from this

community. However, there is clearly a great deal more to language than being able to produce imageable nouns; therefore the study's focus on single nouns does not provide a comprehensive assessment of an aphasic person's difficulties. It would also have been potentially beneficial to explore noun finding in spontaneous speech. Such a study would need to be carried out by a bilingual fluent in the languages being explored. It has proven possible to assess noun naming in Bengali through collaboration with bilingual coworkers, and although it may be possible to explore spontaneous speech data in a language barely known by the researcher through collaboration with coworkers, it is suggested that those coworkers would need to be language specialists able to communicate the intricacies of syntax.

Now that an assessment profile of word finding difficulties has been acquired for each aphasic participant, the next chapter will explore the effects of SLT on bilingual anomia and evaluate the hypotheses regarding how the participants might respond to therapy raised above.

8 Treatment of word finding difficulties in bilingual aphasia

8.1 Introduction

There is a need for more studies exploring how people with bilingual aphasia respond to SLT. This chapter describes the process of carrying out SLT with participants with bilingual aphasia. This phase of the study set out to address the following questions:

- Does word finding therapy improve participants' naming?
- Do both languages benefit from therapy and to the same extent?
- Do word finding gains in the treated language generalise cross-linguistically?
- Do benefits of therapy depend on the type of therapy (i.e. semantic versus phonological) used?
- Can any prognosticators be drawn from the data, i.e.:
    - Is severity of impairment a predictive of therapy outcomes?
    - Does a participant's response to cues in assessment predict response to therapy?

These questions allow evaluation of the hypotheses of therapy outcomes raised at the end of the previous chapter (Section 7.10.4) driven by the assessment data and current models of language processing. These hypotheses will be revisited when evaluating the impact of word finding therapy delivered to the aphasic participants. The discussion will also consider if the stronger or weaker language pre-therapy benefits the most for each participant. Although predictions regarding therapy outcomes have been made, there is little evidence to suggest such predictions can be useful; therefore participants in the current chapter will continue to be presented in the order used in the preceding chapter, i.e. order of severity of naming impairment (most severe to least severe).

8.2 Methodology

8.2.1 Identification of therapy targets

In contrast to the assessment phase, where participants were tested using the same materials, those in the therapy phase selected a vocabulary of 150 nouns that might be used as therapy items. The emphasis was on inclusion of personally significant words so that any improvements following therapy would be functionally useful. Clearly, aphasic participants with word finding difficulties would, almost by definition, have found self-selection of a relatively large group of words a very difficult task. Consequently, selection was facilitated through collaboration with each participant, their family members, and the bilingual coworkers. Rather than provide a list of 150 words for therapy, participants and allies suggested topics, personal interests or semantic categories that might be useful for the participants to work on. The researcher, with the assistance of the bilingual coworker team, then compiled a list of potential targets for each participant.

There were some constraints on the selection of therapy targets. First, selected targets had to be imageable. Second, cognates in Bengali and English were excluded so that cross-linguistic generalisation could be observed. In contrast to the assessment development phase, items that were not cognates in Sylheti and Standard Bengali were permitted. Here, the emphasis was on each individual participant rather than a broad application; therefore the names for a target in each participant's idiolect were considered more important than issues of regional variation. The 150 words formed the naming stimuli for both the assessment and therapy stages of this phase. Likewise, the same images were used for both assessment and therapy in both languages. That is, the same images were used for English and Bengali naming.

Once a list of suitable targets had been agreed, images (mostly colour photographs and drawings) were sourced, predominately on the Internet. The researcher carried out the bulk of this process, but coworkers were again involved in screening images for their cultural relevance for the participants. For example, a

coworker thought the picture of the red Routemaster (Figure 8.1) was likely to elicit the word 'bus' when testing in both languages as it is closely associated with London and its English speaking environment (i.e. when testing Bengali it would elicit the word 'bus' rather than the Bengali word for bus). She suggested that a picture of a bus typically found in Bangladesh with people on the roof was more likely to elicit a Bengali word when testing Bengali as well as eliciting 'bus' in English. Consequently, the London bus was discarded for use in *both* languages and substituted with the photo of a bus typically found in Bangladesh. Additionally, coworkers were also able to suggest some targets where the objects themselves were unknown to the researcher. For example, the fruit pictured in Figure 8.3 is widely known in London's Bengali community but would be unfamiliar to most English speakers. As the Bengali and English names for this fruit are not cognates (/xætʊl/ and 'jackfruit' respectively), this was an entirely suitable target for participants who chose food as a category to work on in therapy.



Figure 8.1: London bus.



Figure 8.2: Bangladeshi bus.



Figure 8.3: Jackfruit.

It was not always possible to select stimuli from all the topics chosen by the participants. For example, the topic of driving, chosen by Rasheda, was problematic as most terms were either cognates or not known to her pre-morbidly in Bengali. Another topic, 'East Enders'(the TV programme), proved difficult because the target vocabulary comprised mainly proper nouns, which do not have translation equivalents, or low imageability terms, e.g. connected with emotions and relationships. Where such difficulties arose, new topics were negotiated with the

participant. In Rasheda's case, chosen categories were animals, occupations, food, and body parts. A list of targets for each participant can be found in Appendix 32.

8.2.2 The design of the therapy study

Figure 8.4 outlines the design of this phase of the project:

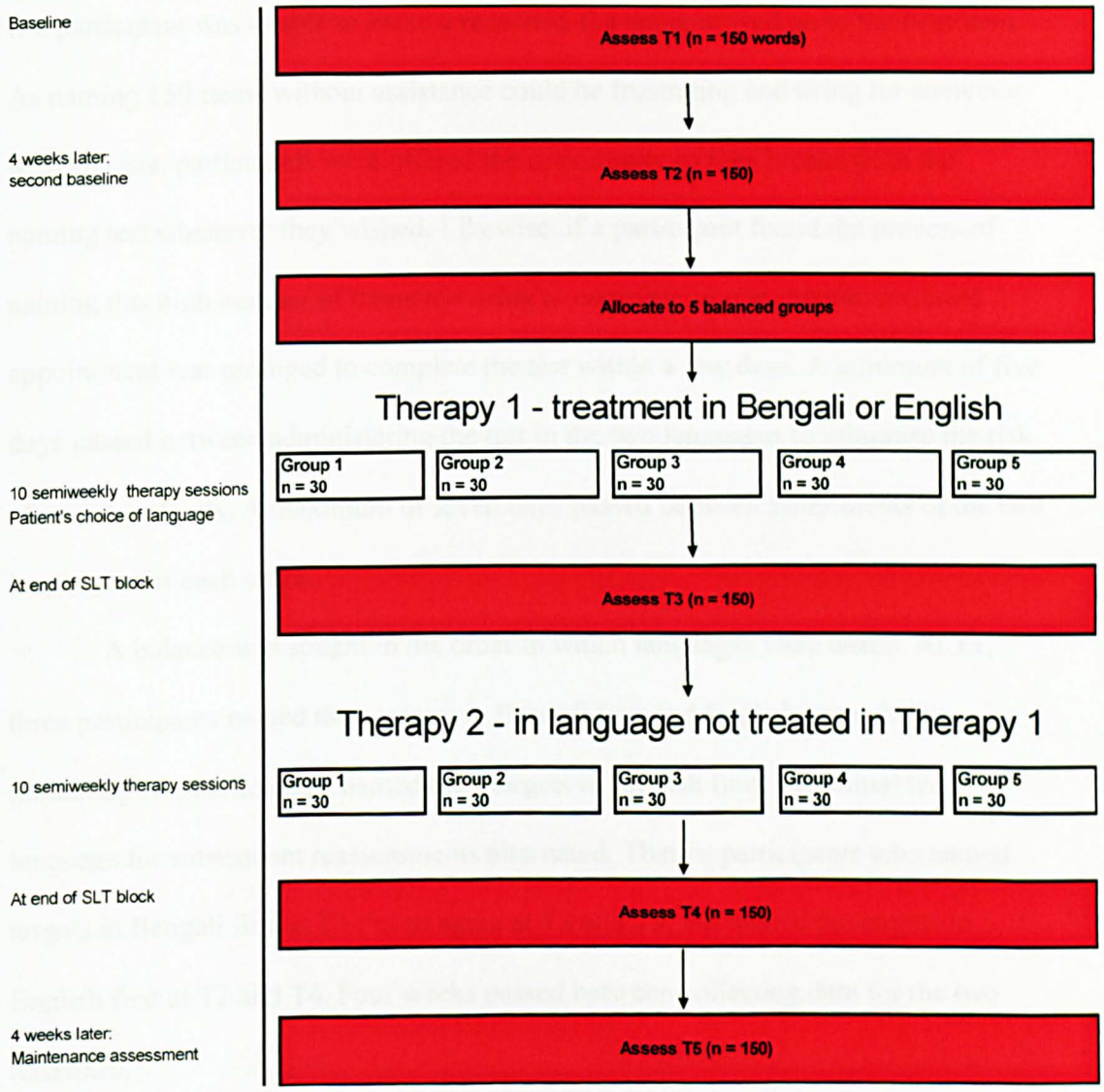


Figure 8.4: Graphic representation of the procedure for the SLT phase of the project.
1. Words in Groups 1 and 2 were treated in Bengali. Those in Group 1 received semantic therapy; those in Group 2 phonological therapy. Words in Groups 3 and 4 were treated in English. Those in Group 3 received semantic therapy; those in Group 4 phonological therapy. Group 5 was a control group and remained untreated throughout.
2. If a participant elected to receive therapy initially in Bengali, Groups 1 and 2 were treated in Therapy 1; Groups 3 and 4 were subsequently treated in English in Therapy 2. For participants who chose to receive therapy in English first, Groups 3 and 4 were initially treated in Therapy 1; Groups 1 and 2 then received treatment in Bengali in Therapy 2.

8.2.2.1 Double baseline assessment

Naming of the 150 nouns was assessed twice in each language to acquire a double baseline. Each time a participant named the 150 items, a different randomised

running order of the pictures was used regardless of which language was being tested. That is, participants never named the pictures in the same order. The procedure for administering the naming sessions largely mirrored that outlined for the naming tests in the assessment phase (Section 7.8.3). However, in this phase, no cues were given. If a participant was unable to make a response, the tester moved on to the next item. As naming 150 items without assistance could be frustrating and tiring for someone with aphasia, participants were offered the opportunity to take breaks from the naming test whenever they wished. Likewise, if a participant found the process of naming this high number of items too tiring to complete in one session, a second appointment was arranged to complete the test within a few days. A minimum of five days passed between administering the test in the two languages to minimise the risk of priming effects. A maximum of seven days passed between assessments of the two languages for each stage.

A balance was sought in the order in which languages were tested. At T1, three participants named their targets in Bengali first and English second. The remaining two participants named their targets in English first. The initial test language for subsequent reassessments alternated. That is, participants who named targets in Bengali first at T1 did so again at T3 and T5, but named the targets in English first at T2 and T4. Four weeks passed between collecting data for the two baselines.

8.2.2.2 Allocation to treatment groups

Once a participant had named the 150 items twice in both languages, the items were allocated to five groups, each containing 30 items. This allocation was not random. The problem with random allocation was that each group would not contain an equal balance of words that had been named in the baseline assessments (e.g. one might include five items that had been named in the baseline assessment, but the other 15). As far as was possible, each group was allocated the same number of named items for each participant based on the second baseline assessment in both languages.

After ensuring this balance, formation of the 5 groups was completed by allocating the remaining unnamed words. Each group was allocated words from each topic chosen by the participant so that no group was dominated by a particular topic. It must be noted that each group is effectively two groups of words, i.e. 30 words in Bengali and their translation equivalents in English. In cases where a participant's naming was inconsistent across baselines, targets were still allocated to groups based on the second baseline data. This inconsistency was noted and taken into consideration when interpreting therapy outcome data.

8.2.2.3 Streaming of the five groups

At this stage, five groups, each containing 30 items, had been established. Each contained the same number (as far as was possible) of correct and incorrect items for each participant. Each group was treated differently. Items in Group 1 were treated in Bengali using semantic therapy tasks. Group 2 was also treated in Bengali, this time using phonological therapy tasks. Groups 3 and 4 were treated in English, receiving semantic and phonological therapy tasks respectively. Group 5 remained untreated and acted as a control group. Given the evidence from recent unilingual anomia treatment studies presented in Section 2.8.4, it was anticipated that any gains from SLT were likely to be specifically on naming treated items. Consequently, items from the untreated control group would remain unchanged throughout the reassessments to demonstrate neurological stability and therefore strengthen the argument for a treatment effect being the reason for any improvements to scores in treated groups.

Participants were allowed to choose which language they preferred to be treated initially. That is, for participants who elected to receive SLT initially in Bengali, words in Groups 1 and 2 were treated first (illustrated as 'Therapy 1' in Figure 8.4), whereas Groups 3 and 4 were treated in English in 'Therapy 2'. For participants who elected to receive treatment in English first, Groups 3 and 4 were initially treated in

'Therapy 1' and Groups 1 and 2 were not treated until 'Therapy 2'. Each block of therapy comprised 10 biweekly sessions.

8.2.3 Content and format of therapy sessions

SLT sessions drew on a selection of tasks that are widely used to treat aphasic word finding difficulties in the UK. All tasks were drawn from studies of anomia where treatment using the tasks had resulted in positive outcomes for aphasic participants. The selection of tasks used in the therapy (along with references to studies where their inclusion in therapy was effective) is presented in Table 8.1. All participants received essentially the same treatment, although some flexibility was required to modify or abandon tasks that were not working well in the sessions.

Semantic tasks
Semantic associate matching (Nickels & Best, 1996).
Functional questions (Nickels & Best, 1996).
Naming to definition (Drew & Thompson, 1999).
Semantic feature analysis (Lowell *et al.*, 1995).
Phonological tasks
Repetition of target in presence of picture (e.g. Hickin *et al.*, 2002).
Phonological cueing (Howard *et al.*, 1985b).
Rhyme judgement (Raymer *et al.*, 1993).
Syllable counting (Rose *et al.*, 2002).
Initial phoneme judgement (Hickin *et al.*, 2002).

Table 8.1: Tasks used in treatment for all participants in both languages.

Each word from the treatment groups was treated once per session. That is, all 30 items from the group treated with semantic tasks (i.e. those that invite the participant to reflect on the meaning of a word) were presented once per session using the same task (e.g. a naming to definition task would be carried out 30 times; each time, the target would be an item included in the semantic treatment group). The same format applies to items receiving phonological therapy (where tasks allow reflection on the sound/syllabic structure of a word). As a consequence, each treated word received largely equal exposure and naming opportunities during each therapy session. On tasks that strove for the production of the target noun, cues were provided to facilitate naming. However, targets treated with semantic tasks only received a

semantic cue (similar to those used in the assessment phase, Section 7.7); phonemic cues were only provided for words receiving phonological treatment. Cross-linguistic cues were not used in this stage of the project.

In summary, each treatment session included two tasks, one phonological and one semantic. In each session, the 60 items from the treatment groups for that language were presented for consideration once. Throughout the treatment block, the first task of therapy alternated between the semantic and phonological tasks (i.e. semantic tasks were completed first for five sessions; phonological tasks were carried out first for the remaining five sessions). This ensured that one type of treatment was not disadvantaged by always being presented second during sessions (i.e. participants' attention may have been less focused as the session progressed because of fatigue). Each session lasted between 45-60 minutes. All participants were offered the opportunity to have a family member present, although in fact most sessions were completed with just the participant, a bilingual coworker (where appropriate) and the researcher present. A description of each therapy task included in the treatment follows.

8.2.3.1 Semantic tasks

8.2.3.1.1 Semantic associate matching

The target picture was presented to the participant above two other object pictures, one of which had a close semantic relationship with the target, while the other had no obvious semantic connection to the target. The participant was invited to identify which item had the closer semantic connection, e.g. "Which one goes best with knife?" from a choice of fork and chimney (Nickels & Best, 1996). Distractor items were taken from a body of pictures that were not part of the treated items or control group for each participant.

8.2.3.1.2 Functional questions

The target picture was presented to the participant. The participant was then asked some closed questions following the template of "Can you **verb** a **target**?", e.g. "Can you kick a football?"; "Can you eat a football?" etc (Nickels & Best, 1996).

8.2.3.1.3 Naming to definition

The participant was presented with a spoken description of a target drawing on semantic features (e.g. target: carrot; "this a type of root vegetable, it's long and thin, orange, and rabbits like to eat them". The target picture was presented to the participant when they produced the correct name in the target language. If they failed to name the item, the picture was still presented and the session leader produced the word (Drew & Thompson, 1999).

8.2.3.1.4 Semantic feature analysis

The target picture was presented to the participant. There followed a discussion of the semantic features for that target. The participant was invited to produce some semantic aspects that were included in his/her definition of the target. The session leader also contributed offering prompts and suggestions as appropriate (Lowell *et al.*, 1995).

8.2.3.2 Phonological tasks

8.2.3.2.1 Repetition of target in presence of picture

The target picture was presented to the participant. The item in the target language was produced by the session leader and the participant was invited to repeat the word (e.g. Hickin *et al.*, 2002).

8.2.3.2.2 Phonological cueing task

The target picture was presented to the participant. The session leader then produced the initial phoneme of the target (i.e. "This word begins with /k/") and the participant was invited to produce the word. If the initial cue was unsuccessful, a longer cue (e.g. the first syllable) was provided. If the participant was still unable to

produce the target, the session leader produced the complete word and the participant was invited to repeat (Howard *et al.*, 1985b).

8.2.3.2.3 Rhyme judgement task

The target picture was presented to the participant. The participant was then asked "Does this word rhyme with X?" A mix of both rhyming and non-rhyming alternatives was provided (Raymer *et al.*, 1993).

8.2.3.2.4 Syllable counting task

The target picture was presented to the participant. If the participant could name the word, s/he did, otherwise it was produced by the session leader. The participant was then asked how many syllables that word contained. If the participant failed to identify the correct number, s/he was invited to tap out the number of syllables with the support of the session leader (Rose *et al.*, 2002).

8.2.3.2.5 Initial phoneme judgement task

The target picture was presented to the participant. The name of the item was established in the target language, and the participant was then invited to identify the word-initial phoneme (i.e. "This word is potato. What is the first sound of potato?"). The aim was that the participant would orally produce the word-initial phoneme. Support was given in the event of difficulties (e.g. "This word begins with /p/. /p/ for potato") (Hickin *et al.*, 2002).

8.2.4 Contrasts between Bengali and English treatment sessions

Treatment sessions in Bengali and English were carried out as consistently as possible so that the difference between the two blocks of therapy was limited to the language treated in the sessions. However, although sessions were presented in the same format in each language, it is clear that some differences beyond the language of treatment remained.

Sessions in English were planned and carried out entirely by the researcher. Consequently, only the participant and researcher were normally present during sessions. During these sessions, English was used almost exclusively. If a family

member was present, it was sometimes difficult to control the language spoken between participant and carer. If a participant made a code-switching error for a target that was recognised by the researcher, acknowledgement of the error was provided and the participant was asked whether he or she could say the word in English. Consequently, at least some Bengali was occasionally used in English treatment sessions even though English was by far the dominant language.

Bengali sessions were delivered by bilingual coworkers, although the researcher still planned the therapy and was present for all sessions. Immediately before each Bengali session, the researcher briefed the relevant bilingual coworker about the impending session. The tasks and their objectives were explained. Bengali sessions were also largely carried out in a unilingual paradigm. Greetings, small talk, arrangements for future appointments, and farewells were in Bengali. The researcher avoided directly addressing the participant in English in these sessions. The coworkers generally carried out the therapy tasks accurately and efficiently. On occasions when the researcher needed to interject to clarify or modify the use of the task, feedback was given in English before allowing the session to continue in Bengali. After each Bengali session, debriefing between researcher and bilingual coworker allowed session feedback to clarify the researcher's queries regarding participant responses (e.g. if a response was unknown to the researcher, was it a synonym or a semantic error, etc).

8.2.5 Reassessments following treatment

After each SLT block was completed, the full list of 150 targets was reassessed in both languages to monitor any changes in naming after therapy. These reassessments followed an identical format to the collection of the baseline data (with the exception of different running orders in each language). Once both blocks of treatment had been completed and progress reassessed, a period of four weeks passed before a final maintenance assessment of the 150 words in both languages was carried out to ascertain the stability of any improvements in naming following treatment.

8.3 Results

All five aphasic participants fully completed all naming assessments and a block of SLT in both Bengali and English. Table 8.2 indicates the number of correctly named items for the five assessments (T1-T5) in each language for each participant. Graphs that summarise each participant's assessment scores can be found in Appendix 33. As in Chapter 7, the participants will be presented in the order of severity of naming impairment (most severe to least severe).

Results will be presented as a case series, i.e. including both individual and group discussion. There are precedents for anomia treatment studies implementing a case series strategy for examining data (e.g Hickin *et al.*, 2002; Fillingham, Sage, & Lambon Ralph, 2006). A case series was especially suitable to the current study given the early stage of exploration of this area and the fact that considerable variation between participants was anticipated.

Participant	Assessment no.	Named in Bengali					
		Group 1 (/30)	Group 2 (/30)	Group 3 (/30)	Group 4 (/30)	Group 5 (/30)	Total (/150)
Saleha	T1	1	1	1	1	0	4
	T2	1	1	1	1	0	4
	T3	2	9	0	2	0	13
	T4	2	5	3	4	0	14
	T5	1	5	3	3	0	12
Salma	T1	5	5	8	6	7	31
	T2	7	6	7	6	7	33
	T3	7	10	11	6	6	40
	T4	4	10	7	5	9	35
	T5	6	9	7	6	9	37
Tarik	T1	12	14	15	13	10	64
	T2	17	18	17	17	16	85
	T3	22	26	17	13	18	96
	T4	20	27	22	20	20	109
	T5	21	23	19	20	19	102
Rasheda	T1	5	5	7	7	6	30
	T2	5	5	6	7	6	29
	T3	5	5	12	9	6	37
	T4	13	12	12	7	7	51
	T5	12	12	11	8	7	50
Azad	T1	9	6	7	4	11	37
	T2	8	9	8	9	9	43
	T3	22	22	13	11	15	83
	T4	20	15	12	10	12	69
	T5	21	16	14	11	11	73
		Named in English					
		Group 1 (/30)	Group 2 (/30)	Group 3 (/30)	Group 4 (/30)	Group 5 (/30)	Total (/150)
Saleha	T1	1	0	1	0	0	2
	T2	1	0	1	0	0	2
	T3	1	0	0	0	1	2
	T4	1	0	1	1	0	3
	T5	1	0	2	1	0	4
Salma	T1	1	4	2	0	3	10
	T2	5	5	5	5	5	25
	T3	4	7	4	4	4	23
	T4	0	0	2	2	0	4
	T5	0	0	0	0	0	0
Tarik	T1	11	12	6	6	8	43
	T2	8	7	8	7	8	38
	T3	16	12	12	8	9	57
	T4	8	13	13	15	9	58
	T5	12	13	12	14	13	64
Rasheda	T1	9	11	9	9	10	48
	T2	10	9	10	9	10	48
	T3	15	11	26	20	12	84
	T4	18	12	24	17	11	82
	T5	15	12	24	17	10	78
Azad	T1	7	8	11	6	11	43
	T2	9	9	9	8	10	45
	T3	18	9	8	7	11	53
	T4	19	4	20	18	12	73
	T5	19	5	18	16	13	71

Table 8.2: Correct naming responses for all five assessments for aphasic participants.
1. Double underlined cells indicate these groups received treatment immediately before this reassessment.

8.3.1 Outline of data analysis strategy

Data were initially analysed individually for each participant. In order to avoid reactive data analysis, the data for each participant were analysed using the same strategy. This strategy was determined before the data were collected with a view to addressing the hypotheses raised in Section 8.1. This strategy involved the completion of a number of Chi Square and McNemar tests to answer the following questions (the details in parentheses indicate which data were compared to address each question):

1. Did baseline performances of naming assessments indicate equal performances across the two languages (Chi Square test: All targets in English T1 versus Bengali T1; likewise for T2; 150 items in each test)?

2. Did the participants' naming of the untreated control items remain stable in both languages throughout the experiment (McNemar test: Control group scores for T1 were compared to T5 in both languages; 30 items in each test)?

3. Was there a treatment effect for treated items in each language specific to type of treatment (i.e. semantic versus phonological therapy) and if so, was it maintained (McNemar test: For groups that were treated in the first block of therapy, scores at T2 were compared with T3. For groups treated in the second block, T3 scores were compared to T4. Maintenance of gains was assessed using T4 and T5 scores respectively; 30 items in each test)?

4. Was there cross-linguistic generalisation to equivalent items following semantic and phonological therapy (i.e. specific to type of treatment) and if so, was it maintained (McNemar test: As question 4, but using data from treated targets in untreated language; 30 items in each test)?

Tests were not carried out when a significant result was clearly impossible (i.e. when there were no changes to noun naming following treatment). Of course, not doing a test because it does not look significant does not diminish the subject-wise

error rate. The relatively high risk of type 1 errors is acknowledged. Results of these tests can be found in Table 8.3.

	Saleha	Salma	Tarik	Rasheda	Azad
1. Did baseline scores of naming assessments indicate equal performances across the two languages?					
T1	X	$\chi^2 = 12.50$ $p<=0.001$ (B)	$\chi^2 = 6.4$ $p<=0.05$ (B)	$\chi^2 = 4.51$ $p<=0.05$ (E)	$\chi^2 = 0.61$ NS
T2	X	$\chi^2 = 1.37$ NS	$\chi^2 = 30.44$ $p<=0.001$(B)	$\chi^2 = 6.31$ $p<=0.05$ (E)	$\chi^2 = 0.06$ NS
2. Did the participants' naming of the untreated control items remain stable in both languages throughout the experiment?					
In Bengali	X	X	$\chi^2 = 5.82$ $p<=0.05$	X	X
In English	X	X	$\chi^2 = 2.00$ NS	X	X
3. Was there a treatment effect for treated items in each language specific to type of treatment?					
SLT in Bengali:					
Semantic	X	X	$\chi^2 = 3.2$ NS	$\chi^2 = 4.08$ $p<=0.05$	$\chi^2 = 12.07$ $p<=0.01$
Phonological	$\chi^2 = 6.16$ $p<=0.01$	$\chi^2 = 1.13$ NS	$\chi^2 = 4.90$ $p<=0.05$	$\chi^2 = 5.14$ $p<=0.05$	$\chi^2 = 9.60$ $p<=0.01$
SLT in English:					
Semantic	X	X	X	$\chi^2 = 12.50$ $p<=0.01$	$\chi^2 = 8.64$ $p<=0.01$
Phonological	X	X	$\chi^2 = 5.14$ $p<=0.05$	$\chi^2 = 7.69$ $p<=0.01$	$\chi^2 = 7.69$ $p<=0.01$
4. Were these gains maintained?					
SLT in Bengali:					
Semantic	X	X	X	$\chi^2 = 4.00$ $p<=0.05$	$\chi^2 = 8.64$ $p<=0.01$
Phonological	X	X	$\chi^2 = 5.82$ $p<=0.01$	$\chi^2 = 5.14$ $p<=0.05$	$\chi^2 = 2.5$ NS
SLT in English:					
Semantic	X	X	X	$\chi^2 = 10.56$ $p<=0.01$	$\chi^2 = 6.75$ $p<=0.01$
Phonological	X	X	$\chi^2 = 3.13$ NS	$\chi^2 = 6.13$ $p<=0.05$	$\chi^2 = 5.82$ $p<=0.05$
5. Was there cross-linguistic generalisation to equivalent items following semantic and phonological therapy?					
To Bengali after SLT in English:					
Semantic	X	X	$\chi^2 = 2.29$ NS	$\chi^2 = 4.17$ $p<=0.05$	X
Phonological	X	X	$\chi^2 = 2.77$ NS	X	X
To English after SLT in Bengali:					
Semantic	X	X	$\chi^2 = 4.90$ $p<=0.05$	X	$\chi^2 = 4.92$ $p<=0.05$
Phonological	X	X	X	X	X
6. Was this cross-linguistic generalisation maintained?					
To Bengali after SLT in English:					
Semantic	X	X	X	$\chi^2 = 3.2$ NS	X
Phonological	X	X	$\chi^2 = 3.27$ NS	X	X
To English after SLT in Bengali:					
Semantic	X	X	X	X	$\chi^2 = 8.10$ $p<=0.01$
Phonological	X	X	X	X	X

Table 8.3 Results from Chi Square and McNemar tests addressing questions of the analysis strategy.

1. NS = Test carried out but result not significant.
2. X = Test not carried out (clearly no effect).
3. (B) or (E) indicates the language (i.e. Bengali or English) in which noun naming was significantly higher.
4. Chi Square test used to address question 1.
5. McNemar tests used to address questions 2-5.
6. $df = 1$ throughout.

8.3.2 Saleha

Saleha's naming performance was stable in the baseline assessment, with no difference between number of items named in the two languages, but her scores were essentially at floor in all baseline assessments. Saleha's naming of control items in both languages remained stable throughout this phase of the study. Saleha elected to receive therapy in Bengali first; therefore groups 1 and 2 were treated with semantic and phonological therapy between T2 and T3, and groups 3 and 4 were treated in English with semantic and phonological tasks respectively between T3 and T4.

Semantic therapy in Bengali had no effect on naming in Bengali. Phonological therapy, however, resulted in a significant gain ($\chi^2 = 6.16$, $df = 1$, $p<=0.01$). This was the only group in either language that showed any real change throughout the reassessments. Moreover, this gain was not maintained. After a sharp increase in items named in Group 2 at T3, the ability to name some of these items declined at T4 and T5. Consequently, the improvement resulting from phonological treatment did not remain significant at T5. Neither therapy in Bengali nor English elicited any improvement for Saleha's naming in English. Her scores for all groups remained at floor throughout the assessments.

8.3.3 Salma

Salma named significantly ($\chi^2 = 12.50$, $df = 1$, $p<=0.001$) more words in Bengali than English at T1, although the difference in items named in the two languages at T2 was not significant. There were no significant changes to Salma's naming of control items in both languages throughout the study. No significant naming improvements resulted from therapy in either language.

Salma elected to receive treatment first in Bengali; therefore groups 1 and 2 were treated in Bengali with semantic and phonological tasks respectively between T2 and T3. This was followed by treating groups 3 and 4 with semantic and phonological tasks respectively in English between T3 and T4.

There was some variability in Salma's naming in Bengali throughout the assessments, including the untreated groups. However, none of the small changes observed between assessments was significant.

Treatment in Bengali had no effect on either treated or untreated groups in English. Treatment in Bengali did not, at least, have a detrimental effect on naming in English. Unfortunately, however, treatment in English had negative outcomes on English naming. Immediately after completion of the English therapy block, Salma was unable to name a single word from the groups not treated in English. SLT was also unable to effect an improvement in treated words for both semantic and phonological groups. Indeed, she was unable to name a single word in English from any group in the maintenance assessment. There was, however, no evidence to suggest that Salma had suffered another neurological incident in the meantime.

8.3.4 Tarik

In both baseline assessments, Tarik named significantly more items in Bengali than English (T1: $\chi^2 = 6.4$, $df = 1$, $p <= 0.05$; T2: $\chi^2 = 30.44$, $df = 1$, $p <= 0.001$). The concern that Tarik might still be spontaneously recovering from his stroke was raised in Chapter 7. This unstable pattern of performance continued during the collection of the double baseline for the current phase. Tarik was the only participant in the study who named significantly more control group items at T5 than T1 (in fact only Tarik's naming of Bengali control group items improved significantly ($\chi^2 = 5.82$, $df = 1$, $p <= 0.05$), although his naming of untreated items in English also indicated an upward trend).

Tarik elected to receive treatment in Bengali first. Consequently, groups 1 and 2 were treated in Bengali with semantic and phonological tasks respectively between T2 and T3. Between T3 and T4, groups 3 and 4 were treated in English with semantic and phonological tasks respectively. The data indicate an apparent significant treatment effect of phonological therapy in both Bengali and English ($\chi^2 = 4.90$, $df = 1$, $p <= 0.05$ and $\chi^2 = 5.14$, $df = 1$, $p <= 0.05$ respectively). However, only gains

from phonological therapy in Bengali were maintained in both languages ($\chi^2 = 5.82$, $df = 1$, $p<=0.01$). There also seemed to be significant cross-linguistic generalisation to English after treatment in Bengali ($\chi^2 = 4.90$, $df = 1$, $p<=0.05$), although this was not maintained at the maintenance assessment. However, these positive data must be tempered by the fact that Tarik's double baseline performance was not stable and his naming of control group items was significant better than T1 at T5 (reported above). SLT might have expedited Tarik's recovery, but the fact remains that there was no difference in the final reassessment between his naming of items in the treated versus untreated groups in both languages.

Phonological treatment in Bengali did not result in cross-linguistic generalisation, but semantic treatment in Bengali did result in a significant cross-linguistic improvement ($\chi^2 = 4.90$, $df = 1$, $p<=0.05$). This improvement did not, however, remain significant for the maintenance reassessment. There was no cross-linguistic generalisation following therapy delivered in English.

8.3.5 Rasheda

The assessments at T1 and T2 indicate a stable baseline in both Bengali and English, although Rasheda named significantly (T1: $\chi^2 = 4.51$, $df = 1$, $p<=0.05$; T2: $\chi^2 = 6.31$, $df = 1$, $p<=0.05$) more items in English than Bengali in both T1 and T2 baseline assessments. This is a similar profile to that obtained from tests in the assessment phase described in the previous chapter. Rasheda's naming of control items in both languages remained stable throughout this phase of the study. Rasheda elected to receive SLT in English first. Consequently, groups 3 and 4 were treated in English (with semantic and phonological tasks respectively) between T2 and T3. Groups 1 and 2 then received treatment in Bengali (again with semantic and phonological tasks respectively) between T3 and T4.

After treatment in Bengali, naming in Bengali improved significantly for both groups that received treatment; semantic and phonological treatment resulted in similar and significant ($\chi^2 = 4.08$, $df = 1$, $p<=0.05$ and $\chi^2 = 5.14$, $df = 1$, $p<=0.05$

respectively) gains. These improvements were still present during the maintenance assessment four weeks later ($\chi^2 = 4.0$, $df = 1$, $p<=0.05$ and $\chi^2 = 5.14$, $df = 1$, $p<=0.05$ respectively). The three groups not treated during the Bengali SLT phase remained unchanged. English semantic treatment resulted in a significant ($\chi^2 = 4.17$, $df = 1$, $p<=0.05$) improvement in the equivalent group of words tested in Bengali. Although this improvement was largely maintained, the improvement did not remain significant at the maintenance assessment. No improvements were observed in Bengali for the remaining groups (i.e. the group receiving phonological treatment in English and the then three untreated groups).

After treatment in English, Rasheda's naming of the groups treated with semantic and phonological tasks both significantly improved ($\chi^2 = 12.50$, $df = 1$, $p<=0.01$ and $\chi^2 = 7.69$, $df = 1$, $p<=0.01$ respectively). Although scores in both these groups dipped slightly in later assessments, significant gains were maintained ($\chi^2 = 10.56$, $df = 1$, $p<=0.01$ and $\chi^2 = 6.13$, $df = 1$, $p<=0.05$ respectively). Even though both types of treatment in English resulted in significant improvements on naming in English, semantic therapy clearly resulted in a greater maintained gain. Treatment in Bengali had no effects on any of the groups in English.

8.3.6 Azad

No differences between languages were found in either of the baseline assessments. There were no significant changes to Azad's naming of control items in both languages throughout this phase of the study. Azad elected to receive treatment in Bengali first. Consequently, groups 1 and 2 were treated with semantic and phonological tasks respectively in Bengali between T2 and T3. Groups 3 and 4 were treated with semantic and phonological tasks respectively in English between T3 and T4.

After treatment in Bengali, Azad named more items in Bengali for all groups. This effect was significant for both semantic and phonological therapy ($\chi^2 = 12.07$, $df = 1$, $p<=0.01$ and $\chi^2 = 9.60$, $df = 1$, $p<=0.01$ respectively). Treatment gains were

only maintained for the group receiving semantic therapy ($\chi^2 = 8.64$, $df = 1$, $p<=0.01$). Treatment in English (between T3 and T4) had no effect on naming in Bengali.

After treatment in Bengali, there was some cross-linguistic generalisation of therapy gains to English. This only occurred after semantic therapy, although these naming improvements were both significant ($\chi^2 = 4.92$, $df = 1$, $p<=0.05$) and maintained ($\chi^2 = 8.10$, $df = 1$, $p<=0.01$) through to the final reassessment. All other groups remained stable in English after Bengali treatment. Both semantic and phonological therapy in English resulted in significantly improved naming in treated items ($\chi^2 = 8.64$, $df = 1$, $p<=0.01$ and $\chi^2 = 7.69$, $df = 1$, $p<=0.01$ respectively), while performance in the three groups that did not receive treatment at this stage remained stable. The gains resulting from the SLT in English remained significant (semantic: $\chi^2 = 6.75$, $df = 1$, $p<=0.01$; phonological: $\chi^2 = 5.82$, $df = 1$, $p<=0.05$) for the maintenance assessment.

8.3.7 Case series analysis

8.3.7.1 Naming of control items

Figures 8.5 and 8.6 indicate that the naming of control items did not significantly improve in either language for four of the five aphasic participants did not significant improve over the course of the study. Tarik's naming of control items in Bengali significantly improved ($\chi^2 = 5.82$, $df = 1$, $p<=0.05$). Concerns regarding his potential spontaneous recovery have already been discussed (see sections 7.9.5 and 8.3.4).

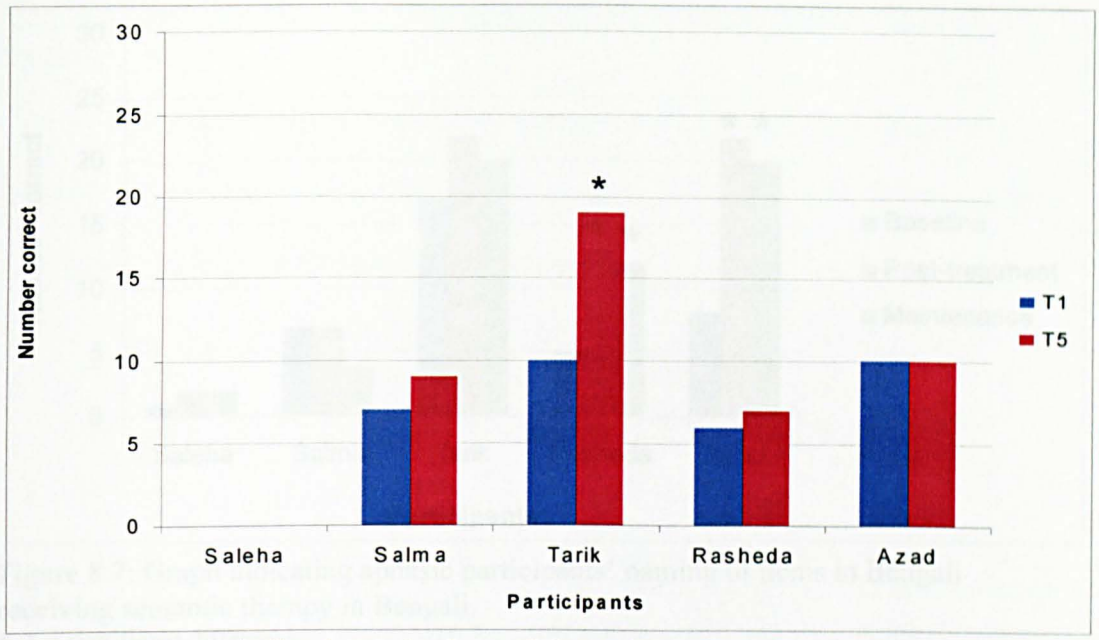


Figure 8.5: Graph indicating aphasic participants' naming of control items in Bengali at T1 and T5.

1. * = significant difference.

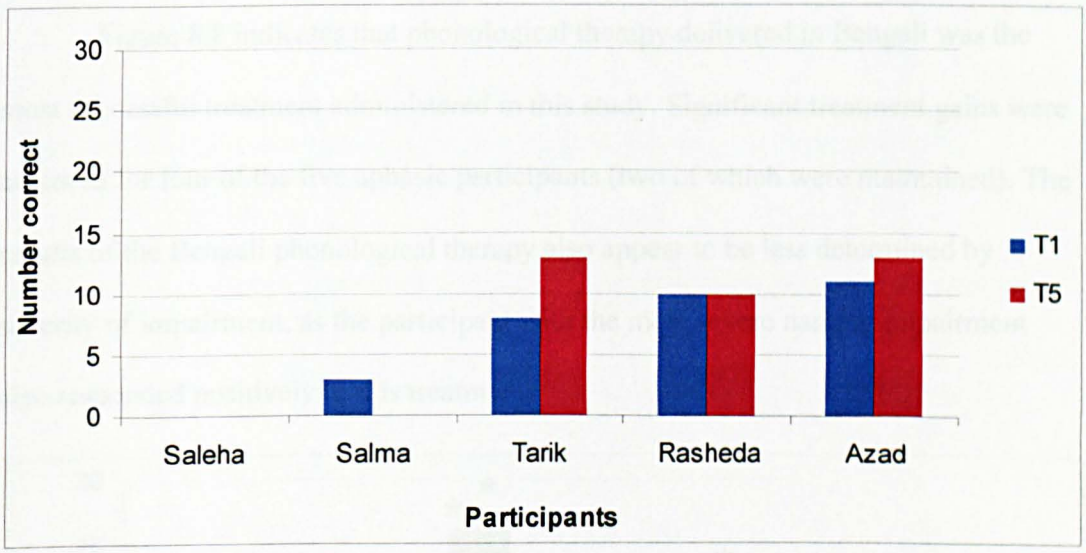


Figure 8.6: Graph indicating aphasic participants' naming of control items in English at T1 and T5

1. No significant differences.

8.3.7.2 Results of therapy delivered in Bengali

8.3.7.2.1 Bengali semantic therapy

Figure 8.7 clearly indicates that the two participants who responded positively to semantic therapy delivered in Bengali were the two participants with the least severe naming impairment.

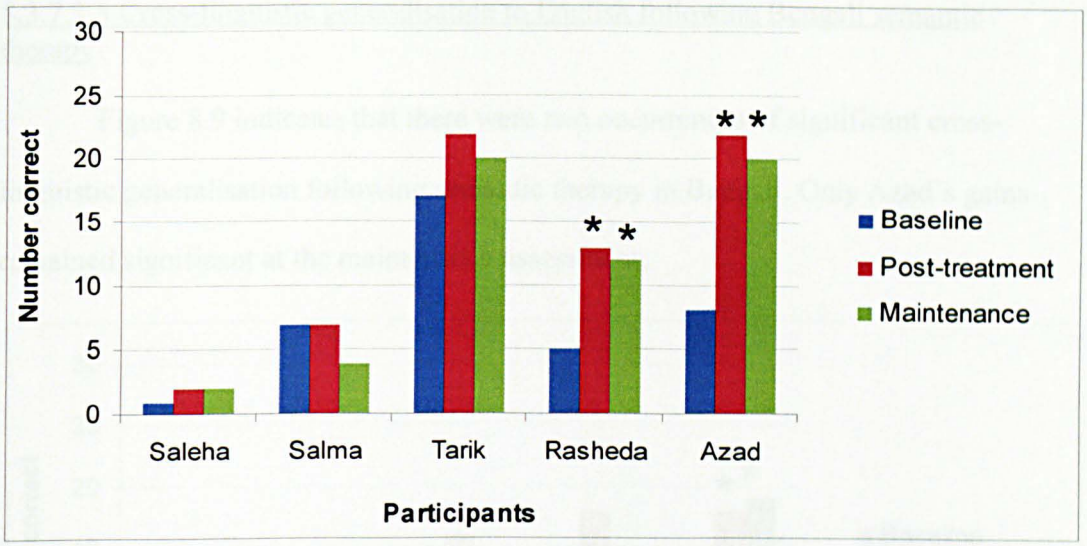


Figure 8.7: Graph indicating aphasic participants' naming of items in Bengali receiving semantic therapy in Bengali.
1. * = significant difference.

8.3.7.2.2 Bengali phonological therapy

Figure 8.8 indicates that phonological therapy delivered in Bengali was the most successful treatment administered in this study. Significant treatment gains were acquired for four of the five aphasic participants (two of which were maintained). The results of the Bengali phonological therapy also appear to be less determined by severity of impairment, as the participant with the most severe naming impairment also responded positively to this treatment.

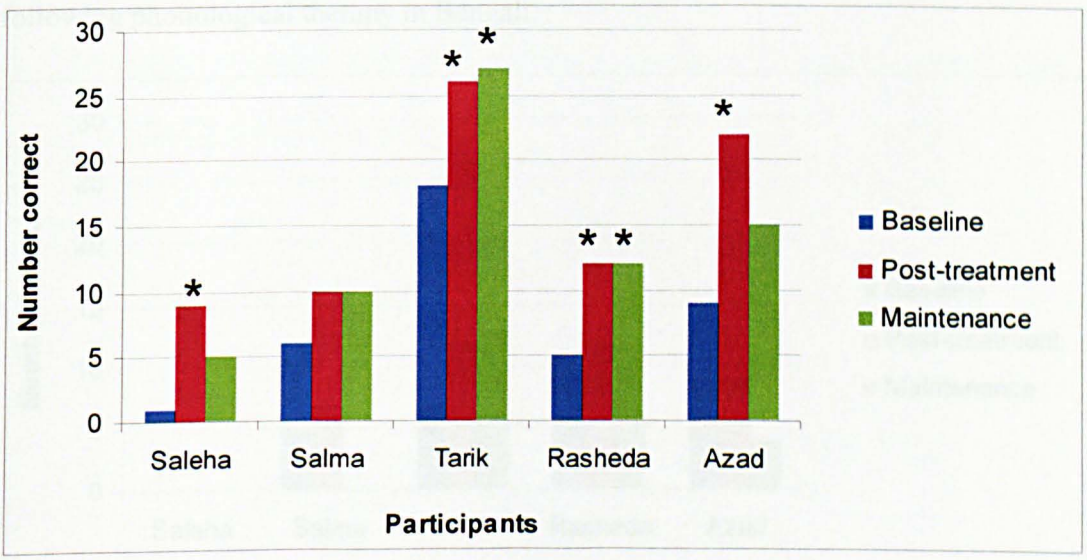


Figure 8.8: Graph indicating aphasic participants' naming of items in Bengali receiving phonological therapy in Bengali.
1. * = significant difference.

8.3.7.2.3 Cross-linguistic generalisation to English following Bengali semantic therapy

Figure 8.9 indicates that there were two occurrences of significant cross-linguistic generalisation following semantic therapy in Bengali. Only Azad's gains remained significant at the maintenance assessment.

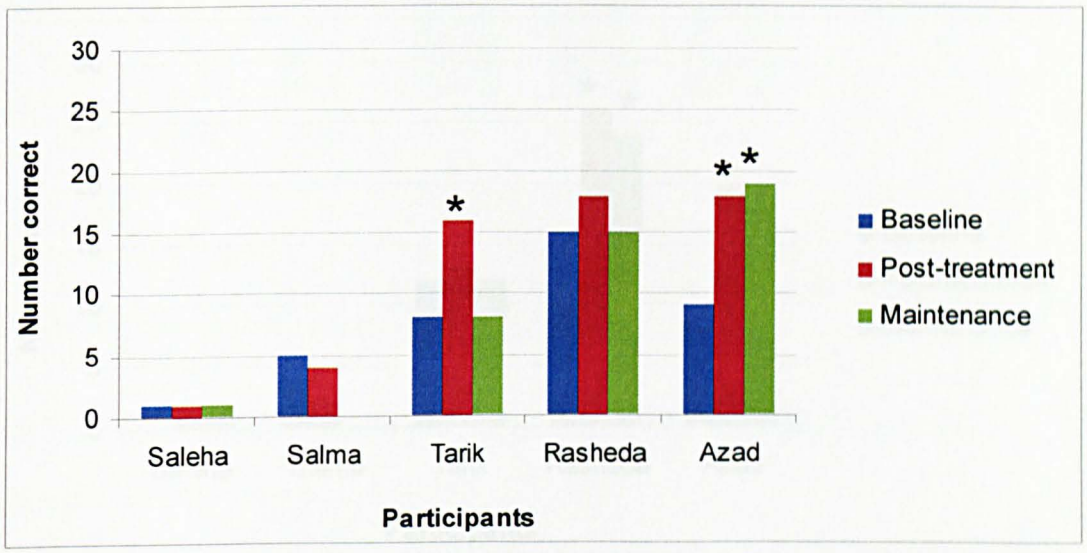


Figure 8.9: Graph indicating aphasic participants' naming of items in English receiving semantic therapy in Bengali.
1. * = significant difference.

8.3.7.2.4 Cross-linguistic generalisation to English following Bengali phonological therapy

Figure 8.10 indicates that there was no cross-linguistic generalisation following phonological therapy in Bengali.

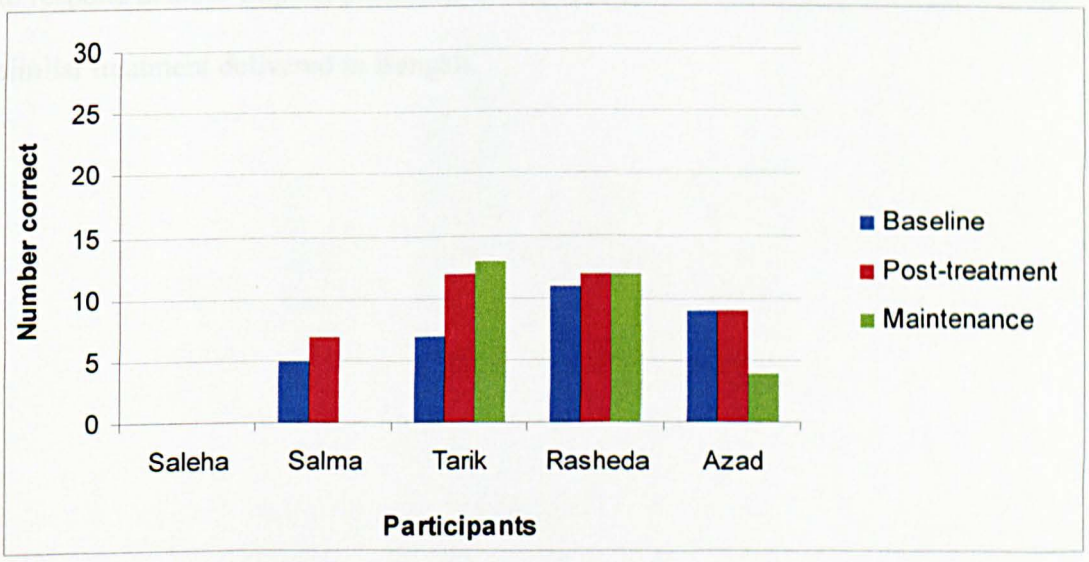


Figure 8.10: Graph indicating aphasic participants' naming of items in English receiving phonological therapy in Bengali.
1. No significant differences.

8.3.7.3 Results of therapy delivered in English

8.3.7.3.1 English semantic therapy

Similarly to the results of the semantic therapy in Bengali, Figure 8.11 indicates that only the two participants with the least severe naming impairments responded positively to semantic therapy delivered in English.

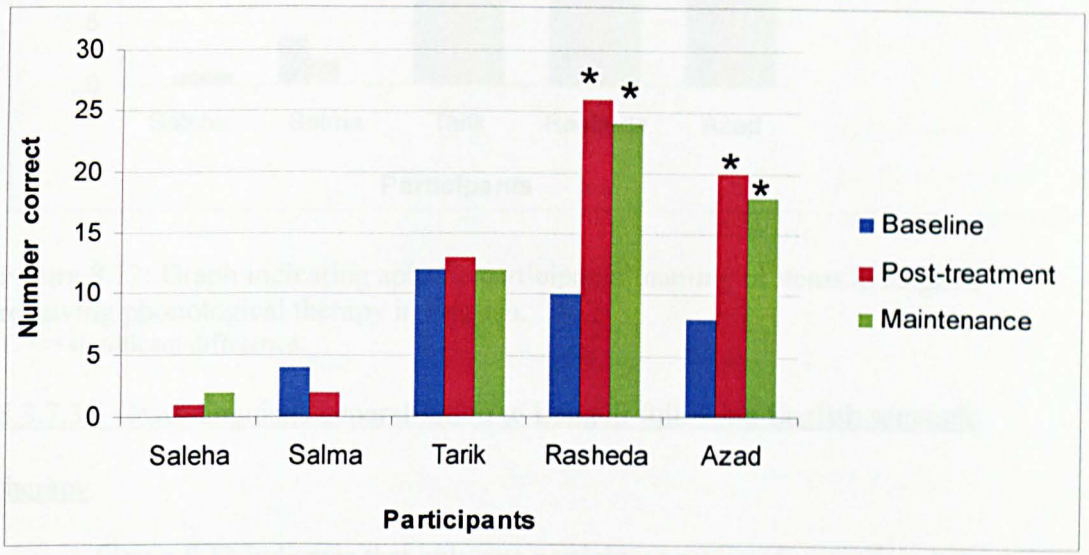


Figure 8.11: Graph indicating aphasic participants' naming of items in English receiving semantic therapy in English.

1. * = significant difference.

8.3.7.3.2 English phonological therapy

As with the Bengali treatment, Figure 8.12 indicates that more participants responded to phonological than semantic therapy in English. However, Saleha failed to respond at all to English phonological therapy, yet she made significant gains from similar treatment delivered in Bengali.

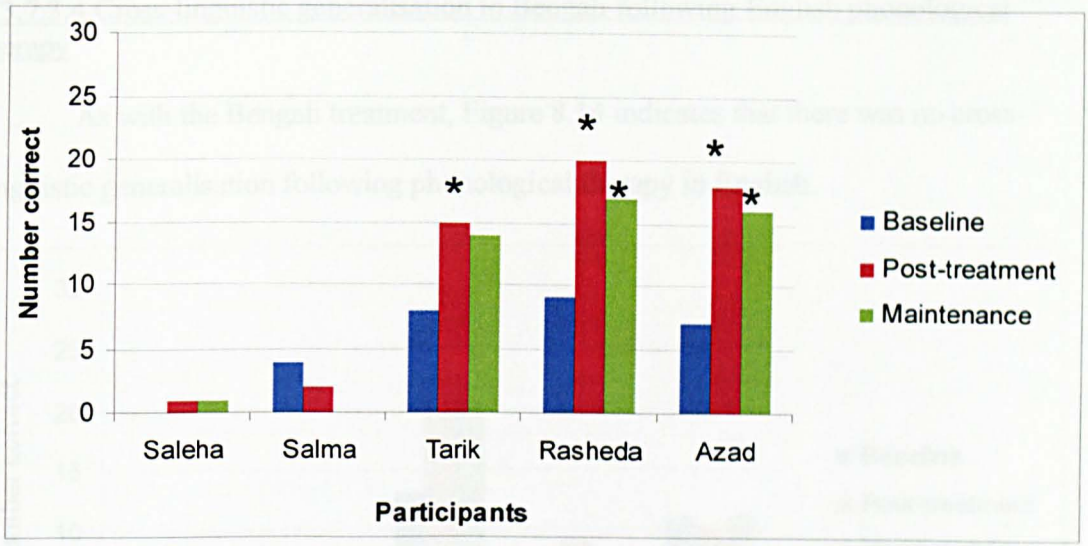


Figure 8.12: Graph indicating aphasic participants' naming of items in English receiving phonological therapy in English.
1. * = significant difference.

8.3.7.3.3 Cross-linguistic generalisation to Bengali following English semantic therapy

Figure 8.13 indicates that only one participant achieved cross-linguistic generalisation to Bengali following English semantic therapy. Notably, Rasheda was the only participant who rated her pre-morbid English ability as being higher than Bengali (despite Bengali being L1).

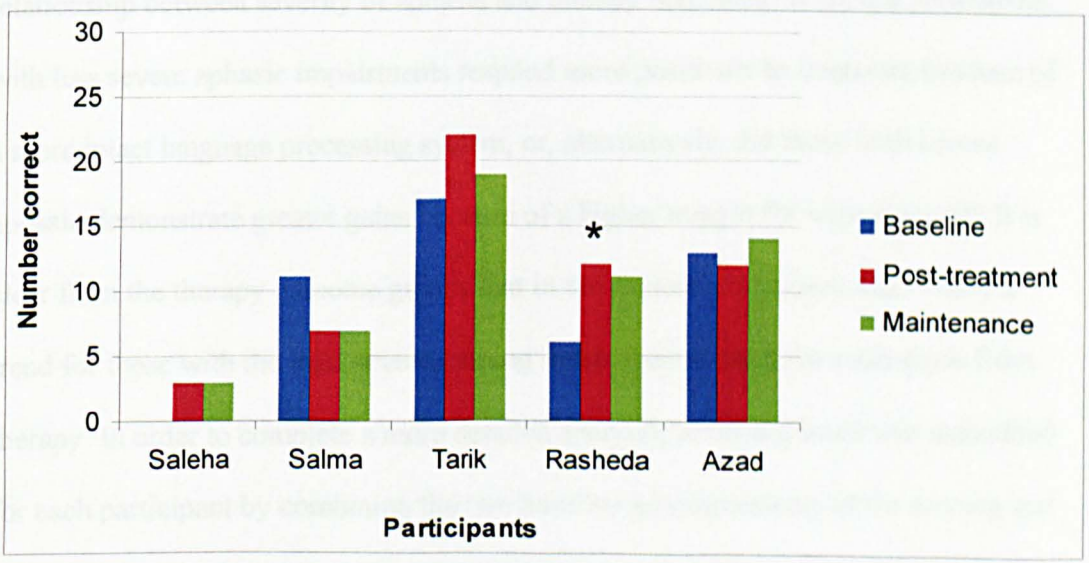


Figure 8.13: Graph indicating aphasic participants' naming of items in Bengali receiving semantic therapy in English.
1. * = significant difference.

8.3.7.3.4 Cross-linguistic generalisation to Bengali following English phonological therapy

As with the Bengali treatment, Figure 8.14 indicates that there was no cross-linguistic generalisation following phonological therapy in English.

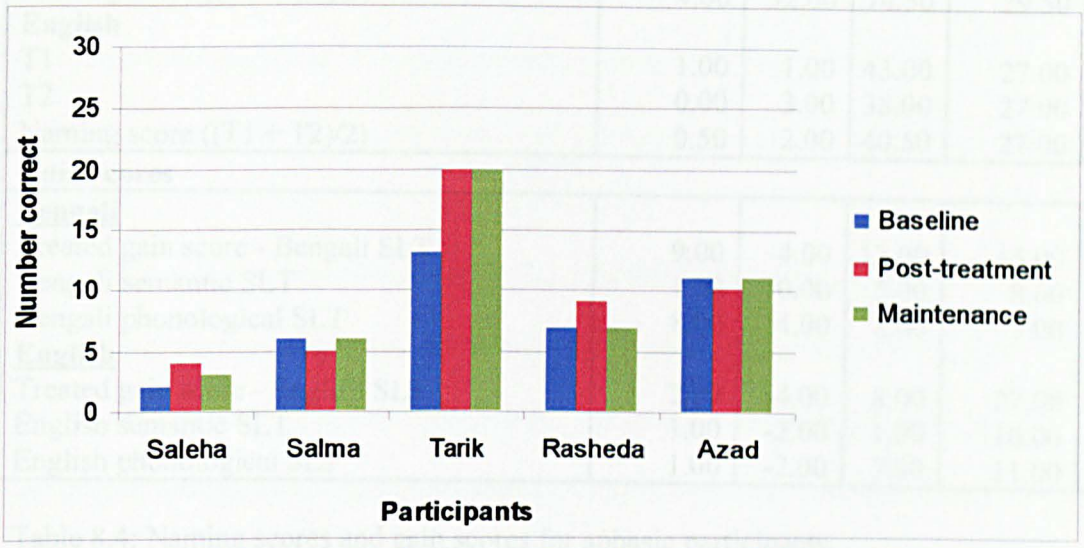


Figure 8.14: Graph indicating aphasic participants' naming of items in Bengali receiving phonological therapy in English.
1. No significant differences.

8.3.7.4 Severity of aphasia as an indicator of therapy outcomes

It is pertinent to explore whether there is a relationship between naming abilities before treatment and responses to therapy. For example, was there a relationship between severity of aphasia and therapy outcomes? If so, did participants with less severe aphasic impairments respond more positively to treatment because of a more intact language processing system, or, alternatively, did those with severe aphasia demonstrate greater gains because of a higher margin for improvement? It is clear from the therapy outcome graphs that in the current study there was clearly a trend for those with the least severe naming impairment to make to most gains from therapy. In order to complete a more detailed analysis, a naming score was calculated for each participant by combining the two baseline administrations of the naming test from the therapy phase for each language and expressing the number of correctly named items as a mean (Table 8.4). Additionally, a therapy gain score was calculated for each participant. This was the increase in items named in treated groups after SLT.

Naming performance and naming score (/150)					
	Saleha	Salma	Tarik	Rasheda	Azad
Bengali					
Assessment T1	4.00	31.00	64.00	30.00	37.00
Assessment T2	4.00	33.00	85.00	29.00	43.00
Naming score ((T1 + T2)/2)	4.00	32.00	74.50	29.50	40.00
English					
T1	1.00	1.00	43.00	27.00	26.00
T2	0.00	3.00	38.00	27.00	23.00
Naming score ((T1 + T2)/2)	0.50	2.00	40.50	27.00	24.50
Gain scores					
Bengali					
Treated gain score - Bengali SLT	9.00	4.00	13.00	15.00	27.00
Bengali semantic SLT	1.00	0.00	5.00	8.00	14.00
Bengali phonological SLT	8.00	4.00	8.00	7.00	13.00
English					
Treated gain score - English SLT	2.00	-4.00	8.00	27.00	23.00
English semantic SLT	1.00	-2.00	1.00	16.00	12.00
English phonological SLT	1.00	-2.00	7.00	11.00	11.00

Table 8.4: Naming scores and gain scores for aphasic participants.

If the group of participants had been larger, it would have been interesting to explore whether a correlation existed between naming score in a particular language and particular therapy outcomes (e.g. was there a correlation between participants' naming score in Bengali or English and therapy outcomes of semantic or phonological treatment?). However, as the number of participants in this part of the study was only five, achieving a significant correlation with such low numbers would have been difficult. Consequently, a broader question was explored: Is there a relationship between naming scores (regardless of which language) and therapy outcomes (regardless of type of treatment)? In order to address this question, a correlation comparing both Bengali and English naming scores to therapy gains from both phonological and semantic treatment (i.e. combined gain scores) was calculated. This allowed 10 pairs of data (i.e. two comparisons for each participant) to be compared, rather than five pairs. This increased the chances of acquiring a significant correlation. This calculation is presented in Table 8.5. Although the correlation resulting from this analysis is non-significant, $r = 0.4$ remains a medium correlation, and could be taken to be indicative of a relationship. Certainly, one must approach

these data with caution due to the small numbers, but discovering a relationship between severity of impairment and therapy outcomes would not be altogether surprising.

Tested variables	r =	p =
Combined naming scores: Overall treatment gain score	.401	.251 ns

Table 8.5: Pearson P-M correlation analysis for naming scores versus therapy gain scores.
1. $df = 8$.

There is also some indication in the data that severity does impact on the potential for gains in therapy to be maintained. The participants with less severe naming impairments (Rasheda and Azad) maintained all therapy gains in both languages through to the final reassessment. That is, significant improvements remained significant after the maintenance period; therefore SLT resulted in lasting improvements for those with less severe impairments. Conversely, Saleha and Tarik, who had more severe impairments, showed significant improvements after treatment but were unable to maintain these.

8.3.7.5 Response to cueing as an indicator of therapy outcomes

As so little evidence is available to guide clinicians when choosing which language to initially treat with clients with bilingual aphasia (see Section 4.7.2), it is pertinent to explore whether participants' responses to cueing was indicative of how they responded to treatment, as evidence exists indicating that responses to cues can be indicative of naming therapy outcomes in unilinguals with aphasia (see Section 2.8.1: Best *et al.*, 2000). If an aphasic participant responds positively to cueing during assessment (no matter how severely impaired uncued naming might be), might s/he respond more positively to SLT than a participant who fails to be facilitated by cueing? In order to explore this hypothesis, cueing scores were calculated from the cueing data from the assessment phase of the project (Section 7.7). A participant's cue score was the percentage of cues that were followed by the production of the target response (Table 8.6).

Cue scores (%)					
	Rasheda	Salma	Azad	Saleha	Tarik
Bengali					
Cross-linguistic cues	0	4.35	20	0	9.1
Phonemic cues	22.22	42.86	42.86	15.79	28.57
Semantic cues	0	0	0	0	28.57
English					
Cross-linguistic cues	0	8	0	0	21.43
Phonemic cues	20	55.77	80	38.98	40
Semantic cues	33.33	7.41	11.43	0	18.75

Table 8.6: Cueing scores (%) for aphasic participants.
1. Phonemic cues in Bengali for Salma and Azad are identical by chance.

As explained in Section 8.3.7.4, achieving a significant correlation with such a small group of participants is difficult. Consequently, correlations were calculated where responses to cues in both Bengali and English were included rather than carrying out correlation calculations on a language-specific basis (thereby doubling the size of the data included in each correlation calculation). This increased the chances of acquiring a significant result which could then potentially be explored with a higher number of participants in future research. Two correlations were calculated to establish whether cue scores for the five participants were correlated with their therapy gain scores presented above (see Table 8.7). Only phonemic cue scores were included in the correlation calculations, as neither semantic nor cross-linguistic cue scores were effective during the assessment of noun naming (see Section 7.9.7). Neither of these calculations resulted in a significant correlation; therefore there is no indication in the data from the current study that responses to cueing during assessment can be indicative of therapy outcomes.

Tested variables	r =	p =
Phonemic cue score: semantic therapy gain score	-.127	.727 ns
Phonemic cue score: phonological therapy gain score	.057	.875 ns

Table 8.7: Pearson P-M correlation analysis for phonemic cue scores versus therapy gain scores.
1. $df = 8$

8.3.8 Summary of results

Overall, there is much in these data that can be taken as positive outcomes of therapy. Of twenty episodes of therapy (semantic and phonological treatment in both languages for the five participants), eleven resulted in significant improvements to naming treated items in the treated language. Four of the five participants demonstrated significantly improved naming of treated items in at least one language. Furthermore, when treatment resulted in a significant improvement to naming treated items, the gains were long-lasting. Eight of the eleven episodes of treatment that resulted in significant improvements remained significantly better at maintenance assessment. However, this optimism must be tempered by the fact that one participant's (Tarik's) data suggest that spontaneous recovery was taking place, as his baseline was unstable and his naming of untreated control items (albeit in only one of the tested languages) improved significantly over the course of the experiment. Likewise, SLT had no effect for Salma, and Saleha's improvements to naming after phonological therapy in Bengali were not maintained following later reassessment.

Both semantic and phonological tasks were useful for at least some participants. Of the ten episodes of semantic therapy carried out, four (two in each language) resulted in significant improvements to naming treated items. There were more instances of phonological therapy effects. Of ten episodes of phonological treatment, seven (four in Bengali, three in English) resulted in significant improvements to naming treated items. However, all gains from semantic therapy remained significant at the maintenance assessment, whereas only four of the seven phonological therapy effects were significantly maintained.

Cross-linguistic generalisation was more limited. None of the phonological therapy effects generalised to equivalent items in the untreated language. Semantic therapy was more prone to generalise cross-linguistically. Of the four instances of significant effects of semantic therapy on the treated language, only one failed to result in significant improvements to naming equivalent items in the untreated

language. However, in only one case did this cross-linguistic generalisation remain significant at the maintenance assessment.

8.4 Discussion

Clearly, there is much to discuss regarding the therapy outcomes. This section will explore the hypotheses raised at the end of the previous Chapter (Section 7.10.4) by considering five main questions:

1. Did treatment have more beneficial effects in one language and how did this relate to baseline performance?
2. Under what circumstances did treatment effects generalise to the untreated language?
3. Can a participant's assessment scores or responses to cueing be taken as an indication of potential to improve with SLT?
4. How successful was the process of carrying out SLT with unqualified bilingual coworkers?
5. How effective was the methodology for this phase of the project?

8.4.1 Did treatment have more beneficial effects in one language and how did this relate to baseline performance?

The majority of participants demonstrated significant improvement to items treated in therapy (3/5 participants with English treatment and 4/5 with Bengali). This indicates that treatment in both languages is potentially beneficial for some participants. These data also provide evidence that demonstrates that SLT tasks typically used in word-finding therapy with unilingual clients can also be beneficial for people with bilingual aphasia.

However, one must approach these data with caution. The small number of participants in this study means that these results can only be indicative and perhaps used as a justification for further study, potentially with larger numbers of participants. Furthermore, one participant failed to improve at all after treatment and another (Tarik) indicated spontaneous recovery, as his naming over the double

baseline was not stable and his naming of control items improved. Some therapy studies have interpreted the improved naming of untreated items as representing generalised therapy gains (see Section 2.8.4). However, it is difficult to argue for that (as opposed to representing spontaneous recovery) here as only Tarik's (who had far the shortest post-onset time) naming of control items improved, whereas some other participants responded equally positively to therapy in their naming of treated items. Indeed, Tarik was the only participant whose naming performance was unstable in the assessment battery (discussed in Chapter 7). Participants whose performance in the naming tests from the assessment battery was stable also demonstrated a stable double baseline in the therapy assessments.

It is also necessary to acknowledge the possibility of order effects in these data. In the absence of any meaningful evidence to suggest which language should be treated initially in clients with bilingual aphasia (see Section 4.7.2), participants in the current study were given the choice of which language they would prefer to receive treatment in first. Consequently, four of the five participants elected to receive therapy delivered using Bengali before English. Order effects may result because of this imbalance. For example, motivation may have been initially high before participants realised how much contact with the SLT they had committed to (even though, of course, this was clarified when obtaining consent). It is possible that participants became less interested or motivated as the experiment progressed (concerns regarding respondent burden are again addressed in Section 8.4.5).

If therapy outcomes are compared with pre-treatment (post-injury) language abilities for each participant, no obvious pattern emerges regarding whether a participant's stronger or weaker language responded more positively to therapy. While there was a clear trend for participants with the least severe naming impairments to respond the best to therapy (see Section 8.3.7.4), participants with differential post-injury language abilities did not show a trend for the stronger (or weaker) language to improve the most after therapy. Three of the participants' scores

on the naming tests (reported in Chapter 7) were significantly different cross-linguistically: Rasheda's English was significantly stronger, while Salma's and Tarik's naming scores were significantly higher in Bengali. However, no obvious pattern in the therapy outcomes emerges: Rasheda responded positively to all types of therapy in both languages, Tarik only responded to phonological therapy but treatment in both languages resulted in significant gains, while Salma failed to respond to any therapy at all. Furthermore, of the two participants whose naming scores were not different cross-linguistically (Azad and Saleha), Azad responded to all types of therapy, while Saleha only responded to phonological therapy delivered in Bengali. With these data, it is difficult to argue for post-injury ability differences across languages impacting on therapy outcomes.

It is becoming increasingly common (e.g. Best *et al.*, 2002; Kiran, Kaufman, & Duff, 2007) for SLT treatment studies to offer evidence of progress during therapy by monitoring performance (which, hopefully, gradually improves) over the course of the treatment. It would be useful to know whether improvements were quickly achieved after early sessions of training, or did improvements evolve over the course of treatment. Unfortunately, the current study is unable to offer data regarding evidence of progress during treatment. This is because even though the participants were exposed to all the treated words during each session, not all the therapy tasks offered the opportunity to name each item spontaneously.

8.4.2 Under what circumstances did treatment effects generalise to the untreated language?

The therapy outcomes offer some evidence to support the notions of centralised semantic processing that have recurred throughout this study. If semantic processing is indeed centralised, one might expect gains from semantic therapy to generalise from the treated language to equivalent items in the untreated language. Clearly, it is necessary here to make the assumption that semantic therapy affects semantic processing, or at least, that it re-engages links between semantic and

phonological processing in a way that phonological processing does not (in contrast to Howard's (2000) suggestion that all therapy, regardless of its semantic or phonological focus, works by re-engaging links between semantic and phonological processing). Evidence in favour of this view was presented in Section 2.8.3, although it is not unanimously accepted. Conversely, gains from phonological therapy would be less likely to generalise cross-linguistically if phonological representations are language-specific and independent.

The occurrence of cross-linguistic generalisation to equivalent items in the untreated language in the current study supports the above position. Although phonological therapy was more effective in the treated language (7/10 episodes of phonological therapy resulted in significant improvements to naming in the treated language), no significant cross-linguistic generalisation at all occurred with items treated with phonological tasks. Conversely, although semantic therapy resulted in fewer significant improvements to naming in the treated language (4/10 episodes of semantic treatment), three of these four instances resulted in significant cross-linguistic generalisation to equivalent items in the untreated language. These data provide good evidence to support the notion that semantic and phonological treatment do indeed activate different parts of the language processing network and result in different outcomes to post-therapy naming. Consequently, this study provides no evidence to support Howard's (2000) suggestion that semantic and phonological therapies both provide the same sort of language stimulation.

These data can also contribute to the debate regarding the architecture of the bilingual lexicon. Gains in the treated language for items that received phonological therapy tasks did not generalise at all to the untreated language regardless of which language received treatment for any of the participants. Consequently, these data provide evidence to appears to support the structure of Costa *et al.*'s (2000) model, where equivalent lexical items in each language, while having connections via semantics, are not directly connected. Conversely, the SOPHIA model, offers a

structure where lexical items for all languages are stored in an integrated lexicon and equivalent items are directly connected. Consequently, this model predicts that activating phonological representations in one language (and indeed gains from phonological therapy in one language) should generalise from the activated (or treated) language to untreated languages. The therapy outcomes from the current study provide no evidence to support this structure. However, these data are also consistent with data from the assessment phase of the current study, where participants generally failed to respond to cross-linguistic cueing and were used to argue against direct connections between equivalent lexical items in Section 7.10.3.4.

It is relevant here to clarify that semantic and phonological therapy took place in the same session with all participants. This might have given rise to some contamination, e.g. where the participant used semantic reflection to cue themselves during a phonological task. However, there is no evidence to suggest that this occurred, especially as some participants showed clearly different responses to the groups treated with semantic versus phonological tasks.

No participant demonstrated significant cross-linguistic generalisation in both languages after semantic therapy. Indeed, for all three participants who demonstrated cross-linguistic generalisation, it was the language that they rated as their weakest pre-morbidly to which generalisation occurred. That is, only treatment in the participants' strongest language pre-morbidly resulted in cross-linguistic generalisation (note that the strongest pre-morbid language was not necessarily the L1 for all participants). Consequently, the evidence from the current study is unable to support the findings of Edmonds & Kiran (2006) (see Section 4.7.4), who tentatively suggested that treatment gains may be more likely to generalise cross-linguistically when treatment is not carried out in the dominant language. Clearly, research exploring cross-linguistic generalisation is at an early stage of development. This is an area which would repay further investigation and one which may have implications for the delivery of SLT.

8.4.3 Can a participant's assessment scores or responses to cueing be taken as an indication of potential to improve with SLT?

Clinicians need guidance about what therapy to attempt and whether therapy is likely to succeed. Predictions of possible therapy outcomes for each participant were suggested in Section 7.10.4 based on the participant's assessment scores and responses to cueing. However, although researchers (such as Nettleton and Lesser, 1991, and Miceli *et al.*, 1996) advocate treating what appears to be a breakdown at the semantic level with semantic therapy and likewise phonological impairments with phonological therapy, there was little evidence in the data that supported the predicted outcomes based on the assessment data. This finding is not altogether surprising, given Nickels (2002) warning that it is not yet possible to pair reliably a therapy task with a particular language impairment and predict an outcome. However, it is clear that the two participants with the least severe impairments responded the most positively following both semantic and phonological therapy.

One way of obtaining an indication of a client's potential response to therapy may be to consider how well the client responds to cues at initial or early assessment. That is, a positive response to cueing during assessment may indicate that a client will respond more positively to SLT than a client who fails to be facilitated by cueing. This is especially pertinent for clients with severe naming difficulties, as they may be responsive to different types of cues even though they may produce very little spontaneous speech.

There did not appear to be a link between responses to cueing and therapy outcomes for the participants in the current study. This result is disappointing. As there is little evidence to lead clinical decisions regarding choice of treatment language (or initial treatment language) (Section 4.6.2), a correlation between responses to cueing during assessment and therapy outcomes would have been highly informative. For example, despite demonstrating poor unaided naming in the

assessment phase, Saleha responded very positively to phonemic cueing. Indeed, this was particularly emphatic in English, where her responses to cueing were significantly better than in Bengali (which was already much better in unaided naming). Given these data, one might have predicted that Saleha would have responded to phonological therapy in English and less so in Bengali. However, the opposite was the case: Saleha's only significant naming improvement followed phonological therapy delivered in Bengali, whereas she failed to respond to phonological therapy in English. For Saleha, solely or initially treating English would appear counterintuitive because of her language acquisition history and social background; therefore evidence of an indication of potential responses to therapy in that language would be highly informative in a clinical setting. Likewise, Salma also responded positively to phonemic cueing but entirely failed to respond to treatment of any type. Alas, the data do not provide this evidence; therefore Roberts' (2001) 'common-sense' approach to clinical decision making in bilingual aphasia therapy must remain the default method in the absence of better clinical evidence.

8.4.4 How successful was the process of carrying out SLT with unqualified bilingual coworkers?

This study has provided strong evidence of effective delivery of SLT through non-specialist bilingual coworkers. Indeed, there were more occurrences of significant improvements to naming following SLT delivered through a bilingual coworker than those carried out in English directly by the SLT himself (4/5 of the SLT blocks delivered by the bilingual coworkers resulted in significant naming improvements in the treated language). This is evidence supporting the feasibility of delivering effective SLT through collaboration with largely untrained coworkers.

Despite this success, the process was not without its difficulties and challenges. In contrast to SLT assistants who work specifically for SLTs, the coworkers in this project were thrown in at the deep end, as it were. With the exception of brief and limited training, they were expected to carry out SLT tasks

with the aphasic participants despite their essentially lay understanding of the difficulties and challenges of working with people with aphasia. This suggested that it was imperative that the SLT was present for all sessions. Nevertheless, the roles of the coworkers were certainly more than translators during SLT sessions. That is, they were not simply a language conduit between SLT and participant; the role was far more active than that. However, it was the SLT who planned and drove the SLT sessions. Allowing ten minutes immediately prior to contact with a participant was essential to briefly explain the content and rationale of the session. This time also allowed them to ask any questions regarding the session and to comment on the session plan. One should also acknowledge that the nature of the therapy tasks was highly suited for use with unqualified coworkers. All the tasks used in the study (and in noun naming therapy generally) were highly prescribed, repetitive, and easily carried out. Had the coworkers required a deeper understanding of the rationale driving the therapy, or needed to be more reactive to participants responses, the therapy carried out by the coworkers may have been less successful.

Effective communication between coworker and SLT was essential to this method of delivering therapy. The coworkers were selected for their intelligence, motivation and strong interpersonal skills. They were not, however, familiar with speech and language therapy or aphasia. As a result, they occasionally required guidance during therapy sessions, e.g. to correct errors in the administrations of tasks. It is encouraging that therapy was successful despite these potentially disruptive interventions.

During sessions it was not always possible to comply with the goal of speaking only the target language. When it was necessary for the SLT to interject, this had to be done in English. However, this did not greatly interfere with delivering therapy in the target language. Comments were made briefly and quietly with a short apology to the participant to acknowledge the interruption. Following this necessary feedback, the session was resumed in the target language. A further issue to discuss is

that of maintaining the privacy of participants and coworkers. Although the Bengali community in London is quickly growing and dispersing (primarily across the north and the east of the city), it remains quite close-knit. The issues of maintaining confidentiality were thoroughly explained to coworkers during their training period and reinforced throughout their participation in the project. In a close community, it is feasible that a coworker might have known a member of an aphasic person's extended family. This situation might have led to a breach of confidentiality which would clearly be unacceptable, even though it may have appeared harmless to those involved. Conversely, it may also be the case that the aphasic participant's family have mutual contacts with those of the coworker. It is important to some people in the Bengali community to establish the family background of other Bengali people they encounter (and, indeed, to establish how much property and land that person may have back in Bangladesh). For example, as a white British male, the SLT's background was never questioned by participants' families, whereas the coworkers were often enthusiastically questioned regarding their circumstances. Indeed, one such interrogation unearthed mutual contacts which resulted in the coworker feeling that her privacy had been violated. Furthermore, it is difficult to see how the SLT could have avoided such difficulties, as these initial introductions between family and coworker were normally performed in Bengali.

Another area worthy of comment is how the dynamic of the SLT sessions changed when the second block of treatment began. All participants received two blocks of treatment, one in each language. Four of the five participants elected to receive treatment in Bengali first and consequently became familiar with meeting the SLT with a coworker, who, it appeared, was often seen as an ally from their own community. It was clear that some participants missed the presence of an ally during English treatment sessions, even though family members were encouraged to sit in on sessions if they wished. Likewise, the SLT now played a different role during sessions. From overseeing sessions during Bengali treatment, the SLT now played a

very active role. It was clear that some participants found the change of situation surprising and the reasons for the change may not have been immediately clear (although the SLT did of course attempt to clarify and explain what was happening and the reasons for the change). However, when family members were present, they often had to be discouraged from helping out in Bengali, as English was the target language for the session. Conversely, for the participant who elected to receive treatment in English first, the change to Bengali treatment and the accompanying coworker was not welcomed. During therapy in English, the participant and SLT developed a positive rapport, and sessions were made more enjoyable by the participation of a younger cousin. This rapport was not maintained after the switch to treatment in Bengali and the participant's motivation to participate decreased rapidly.

Finally, it is also pertinent to acknowledge the complications of working with a language with many regional variations (see Section 5.5). All the aphasic participants who received therapy were born in Sylhet, as were all members of the bilingual coworker team. All participants learned Sylheti as a L1. However, over the course of the project and especially the therapy phase, it became clear that 'Sylheti' includes many further regional variations in vocabulary. These were beyond the control of the current project, but this situation did create awkward moments when an aphasic participant produced a variation of a word in Bengali that was unknown to the coworker, even though the coworkers played an active role in identifying words to be included as therapy targets. There was a danger here that an appropriate response might have been rejected by the coworker as being incorrect. It is likely that most rejected responses were in fact paraphasic errors, as they were often clearly either semantically or phonologically related to the target, or neologisms. During therapy, coworkers offered participants what they considered the correct name for the picture after errors. On most occasions, the participants accepted the suggestion, but on others, the participant rejected the suggestion and maintained his or her own suggestion was 'correct'. Where possible, a family member of the aphasic participant

was asked to confirm the participant's use of the word. Alternatively, the coworker checked a dictionary at home or asked peers in the Bengali community about the unfamiliar suggestion.

8.4.5 How effective was the methodology for this phase of the project?

Research studies exploring SLT with bilingual people with aphasia are still unusual. Using a case series design facilitated the exploration of the research questions discussed above, especially considering that the study of bilingual SLT is in its infancy and the fact that variations in performance and impairment between the participants was anticipated. However, it is necessary to acknowledge some shortcomings in the design.

One concern is respondent burden. The study design required participants to name 150 words on five different testing occasions in each language. While similar burdens are imposed in unilingual naming studies (e.g. Hickin *et al.*, 2001), here the task was doubled by the need to assess in both English and Bengali. The assessment was also particularly burdensome for participants with limited naming success. It is difficult to see how this problem can be overcome, especially if more evidence of the effects of therapy in bilingual populations is to be gathered. It does underscore the need to select participants who are able and willing to comply with testing.

It is also pertinent to consider whether it was actually the SLT tasks that effected any improvements in naming. Could ten sessions of simply naming the pictures have resulted in equal improvements in naming? It is possible that simply practising naming the pictures with the help of an untrained ally, possibly a family member, might also have had an effect on the participants' picture naming. However, given that most participants failed to improve their naming of control items after five episodes of testing, the data provide evidence that simply being presented with a picture to name regularly does not improve one's ability to produce that word.

A potential bias in the assessment data must also be acknowledged. The researcher carried out all SLT in English and oversaw all SLT in Bengali. For the

sake of consistency and to avoid potentially overwhelming participants with a string of new faces, each participant was allocated a bilingual coworker who attended all Bengali therapy sessions for 'their' participants. The researcher and the allocated bilingual coworker normally also carried out all assessments for each participant. It would have been beneficial if a different researcher or SLT and bilingual coworker had carried out the assessments in order to minimise researcher bias in the data collection. However, in defence of the data, picture naming generally results in a concrete response that can be marked as either correct or incorrect. No feedback (except non-specific encouragement) was given to participants during assessments; therefore it is reasonable to argue that the assessment data are a fair representation of the participants' naming abilities throughout the project.

As the risk of a type 1 error increases the more one analyses a dataset (Pring, 2005), one must acknowledge this danger in these data, given that so many McNemar tests were necessary to complete the analysis of the data. The risk of a type 1 error is particularly relevant here as most tests produced non-significant results. Consequently, a great deal of importance has been attached to a significant result when it appeared. It might have been considered important to use a Bonferroni correction here to minimise risk of type 1 errors. However, this would have made it very difficult to obtain any significant result. In fact, a Bonferroni correction was not incorporated into the statistics. This was because this area is an under-researched field and the current exploratory study could indicate areas for future research. However, although the risk of type 1 errors remains, that testing was motivated by a predetermined plan for analysis that was applied to the data for each participant. That is, it was not the case that data were acquired and then explored for what might be interesting. The data for each participant were systematically analysed to address predetermined questions.

Finally, one might suggest that the methodology of this phase did not embrace the bilingualism of the participants. That the therapy sessions were carried out in an

essentially unilingual paradigm has been emphasised throughout this chapter. Code-switching amongst bilinguals is entirely normal when they speak the same languages. Could this have been used as an asset during therapy? Indeed, all aphasic participants found themselves in the position of being able to access the word in the non-target language but unable to access it in the target language at some point in the project. In fact, this criticism is not justifiable, on both methodological grounds and from what was learned from earlier studies of bilingual rehabilitation. Methodologically, if code-switching was incorporated into the therapy sessions, it would not have been possible to explore cross-linguistic generalisation following treatment, as both 'English' and 'Bengali' treatment might have ended up being essentially very similar. Even though the researcher learned a little Bengali during the project, there would have been a *great imbalance between the* researcher's potential to explore code-switching and that of the *bilingual* coworkers. This would have meant that comparing treatment in one language versus the other would have been less robust. Furthermore, a great deal of the previous research exploring rehabilitation of bilingual aphasia (reviewed in Section 4.6.2) does not recommend simultaneous treatment of two languages in order to avoid potentially confusing clients and inhibiting their spoken output. Likewise, the heart of this project aimed to explore the clinical implications of carrying out SLT with people with bilingual aphasia. As most SLTs in the UK will be unable to code-switch with bilingual clients, incorporating an exploration of code-switching in therapy would not be representative of clinical practice in this country.

8.5 Summary and review

This chapter has presented an exploration of carrying out SLT targeting word finding difficulties with people with bilingual aphasia, an area where only limited evidence exists. The data indicate largely favourable outcomes of therapy. It would be misleading to suggest that therapy was a resounding success for all participants, but four of the five aphasic participants demonstrated a significant improvement in naming from at least one block of treatment. Although one participant failed to

respond positively to any treatment provided, three participants demonstrated significant improvements following therapy in both languages. These data also provide evidence of positive outcomes with bilingual participants using therapy tasks that have been shown to be beneficial for unilingual people with aphasia. Likewise, the study has also provided evidence of largely positive outcomes to therapy carried out in collaboration with bilingual coworkers. Possible indicators of therapy outcomes have been considered, as have the circumstances where cross-linguistic generalisation might occur. As there are so few studies exploring therapy with people with bilingual aphasia, the methodology for this phase genuinely explored new ground. Consequently, how this design worked in practice has been considered and suggestions regarding how it might be improved for future studies have been made. The final chapter in this study will explore the clinical implications of the results of this project.

9 Word finding difficulties in bilingual aphasia: Conclusions

9.1 Introduction

This study has introduced many ideas, approaches and theories, and reported a relatively large amount of data. This chapter is an opportunity to summarise the study and to recapitulate its findings. The need for research in this area will be reiterated before the three main research questions addressed by the study are considered. The study will conclude by examining its implications for clinical practice and considering directions for future research.

9.2 Restatement of the need for this research

Anomia is a common symptom of aphasia (Kohn & Goodglass, 1985; Bates & Goodman, 1997; Davis, 2000). It has also been the focus of a great deal of research. There is growing evidence of positive outcomes following rehabilitation targeting word finding difficulties with unilingual participants. This also reflects the clinical practice of SLTs working with aphasia, as treating word finding difficulties is a common therapy target (Whitworth *et al.*, 2005). Even though SLTs can not yet reliably pair a therapy task with a particular language impairment and predict an outcome (Nickels, 2002), the numerous studies of treating anomia have yielded robust evidence of effective outcomes of therapy.

Less is known about anomia in bilingual people or the effect of speech and language therapy on bilingual language disabilities, despite the fact that at least a third (Wei, 2000) and possibly a majority (Grosjean, 1982; de Groot & Kroll, 1997) of the world's population is bilingual. The study of bilingual aphasia is growing, but there is still limited evidence available to clinicians treating bilingual clients with aphasia. RCSLT (2005) recognises that bilingualism is an advantage and that all individuals have a right to access SLT and receive treatment in their first language regardless of their ethnic background. However, as evidence for treating bilingual people with language difficulties remains limited, these ideals remain difficult to implement (Stokes, Thakaria, & MacLeod, 1999).

This study sought to develop our understanding of the assessment and treatment of anomia, an area that has been widely researched, through working with bilingual participants, i.e. a population for whom little evidence for rehabilitation is available. On a local level, working with people with bilingual aphasia from London's Bengali community was important as there are currently limited assessment materials and evidence of outcomes of SLT for this population, even though the Bengali community constitutes a large ethnic minority in London's East End, an area covered by the funders of this research.

9.3 Reviewing the research questions addressed by the project

This study sought to explore three main research questions exploring the assessment and treatment of anomia in a group of Bengali-English speaking bilinguals with aphasia from London's Bengali community:

9.3.1 Is word production similarly impaired in languages in a sample of people with bilingual aphasia?

In cases of bilingual aphasia, a key question is whether word finding is equally affected in both languages. This has implications both for models of bilingual lexical access and for rehabilitation. A number of patterns are possible in bilingual anomia. There may be equal performance across languages, or an unequal performance reflecting acquisition history (e.g. where L1 is stronger than L2). Alternatively, there may be unequal performance that reflects a differential impairment. To date, the evidence suggests that differential impairments are less common than a balanced recovery that reflects pre-morbid abilities (Paradis, 2001).

Investigating this question requires well-controlled cross-linguistic naming assessments. As Paradis (2001) stresses, simply translating tests that were developed for other languages and cultural communities is unreliable. Furthermore, test development is difficult for little researched languages, because lexical values such as frequency and age of acquisition are not available. This is the case for many of the South Asian languages spoken in the UK, including Bengali.

In order to address this question, tests of word finding were developed that were robust, reliable, and suitable for carrying out with people from a Bengali cultural background. Although the researcher is not a member of the Bengali community, steps were taken to protect the tests from cultural bias. A Bengali-speaking SLT acted as a consultant to the test development process and was able to offer advice regarding the content and format of the tests. The tests are also linguistically valid. That is, one can be confident that the targets included in these tests are of largely equal difficulty in the two languages in which they were carried out. Accuracy and latency data were collected for 150 pictures in each language from a group of 20 participants without brain injury from London's Bengali community (a range of L2 abilities, education, occupation, and migratory history were included). Only targets that emerged from the control data with high naming agreement and well-matched latencies across the two languages were included in the tests carried out with the aphasic participants. The format of the tests was based on the PALPA (Kay *et al.*, 1992), an assessment battery that is widely used in the UK for English-speaking clients. Consequently, it was also possible to compare how aphasic participants scored on the PALPA equivalents of word retrieval tests developed in this study. The performance of the participants without brain injury provided control data for the tests to indicate expectations of unimpaired scores for the tests. Indeed, for tests where control data were collected, the scores of participants without brain injury indicates that the tests are of largely equal difficulty in the two languages. Control participants consistently scored close to ceiling; the standard deviations in control scores were small.

Before it is possible to compare acquired impairments in languages spoken by bilinguals with aphasia, it is clearly imperative to establish participants' pre-morbid language history, abilities and use (Paradis & Libben, 1987; Grosjean, 1989; Roberts, 2001). Grosjean (1989) argues that every bilingual person will have a unique linguistic configuration and is not the sum of two complete or incomplete unilinguals. It is therefore unacceptable to make assumptions regarding pre-morbid language use

and it is necessary to develop a profile of language skills before illness. It is often difficult to establish pre-morbid language and especially L2 abilities, but data were collected in the form of an interview and self-rating scales developed by Paradis & Libben (1987). This at least provided an indication of participants' pre-morbid language competence and use.

A large proportion of studies exploring bilingual aphasia have explored patterns of impairment and recovery in bilinguals following brain injury. A wide range of (sometimes bizarre) patterns of impairment and recovery have been reported. Although the aphasic participants in the current study varied in severity of impairment, most performed equally across the two languages assessed. There were five discrepant scores: Three in oral naming, one in spoken word to picture matching and one in repetition. Discrepancies were not all in favour of L1, although they were in line with self-rated pre-morbid competencies.

Consequently, despite some cross-language differential tests scores, it is difficult to argue that these differences indicate differential impairments as opposed to simply reflecting pre-morbid abilities, regardless of the steps that were taken to ensure that the tests were of largely equal difficulty in the two test languages. The data suggest that differential impairments are rare or difficult to identify. This is especially the case in bilinguals who did not learn their languages simultaneously. Despite the attempts of acquiring pre-morbid acquisition histories and self-ratings of language abilities for all participants, the method of data collection employed (i.e. a questionnaire) was quite crude; therefore results must be approached with caution. Although there were some differential scores in the two languages assessed, the impairments demonstrated by aphasic participants in this study appear to indicate that, for this group at least, impairments are equal or reflect an imbalanced pre-morbid ability. Similarly, despite high self-ratings of pre-morbid literacy, two participants were completely unable to complete tests of written naming, reading aloud, and written word to picture matching, even in their L1. Poor literacy may be a cause for

embarrassment; therefore this may indicate poor pre-morbid literacy as opposed to a severe impairment.

It is also notable that differential scores were found in both directions in the tests. That is, as evidence exists demonstrating a greater impairment for some participants in both Bengali and English, the difference cannot simply be a bias of the tests, where the targets in one language might have been more difficult than the other. Both the serial and interactive bilingual language processing models have proven useful as providing structures which can be used to suggest loci of language breakdown. However, neither model can account for all the difficulties encountered by the aphasic participants.

Cueing data may be informative in bilingual testing as an additional means of comparing performance across languages. Consequently, this study also explored how three different types of cueing impacted on the word retrieval of the aphasic participants. Of the three types of cue offered to aphasic participants (semantic, cross-linguistic, and phonemic), phonemic cues were by far the most useful in facilitating word retrieval in both target languages. The evidence of semantic cues rarely facilitating picture naming is consistent with the studies of cueing with unilingual aphasic participants.

Cross-linguistic cues were also ineffective as a means of facilitating word retrieval. This contrasts with the findings of Marshall *et al.* (2005), who presented evidence of an aphasic participant responding positively to cross-linguistic cues (although this evidence may not be directly comparable to the current study, as the aphasic participant was a British Sign Language/English bilingual; therefore was able to produce her two languages simultaneously). Consequently, the cueing data from the current study do not support theories of direct connections between lexicons in bilinguals. It may be the case that age of acquisition impacts on connections between lexicons, although none of the participants showed an effect of cross-linguistic cues despite varying acquisition histories. Although one might have anticipated that cross-

linguistic cues would be more effective for facilitating word retrieval in participants with bilingual aphasia, Green's (1986) bilingual serial model of language processing has been used to account for these data, as it has no direct connections between lexicons.

Phonemic cues clearly had a much stronger effect than the other cues. The phonemic cueing effect becomes even more compelling when one considers that aphasic participants only received a phonemic cue for items that they had failed to name following either a semantic or cross-linguistic cue (at least, in the novel naming tests). This effect is unsurprising, as it replicates findings in several studies of unilingual picture naming.

One participant demonstrated a differential ability to respond to cues. As she performed at floor in the naming tests, this might be taken as evidence of a differential impairment, especially given that she was more responsive to cues in her L2. Indeed, this is the one differential result where the performance does not match pre-morbid ability. However, an alternative explanation of these data has been explored. Aphasic participants indicated a trend to be more responsive to cues when the target language was L2. Theories of differing activation resting levels have been used to explain these data.

9.3.2 Is word finding improved by speech and language therapy and do effects generalise to the untreated language?

This study explored the treatment of word finding difficulties in people with bilingual aphasia, an area where only limited evidence exists. As a result, clinicians lack evidence on which to base decisions when working with bilingual clients. Aphasic participants in the current study who demonstrated word finding difficulties in the assessment phase received treatment targeting those difficulties. Participants received two blocks of treatment, one in English, and one in Bengali, the latter being carried out in collaboration with bilingual coworkers. This process explored whether therapy in one language elicits a greater improvement in picture naming than the

other. The data clearly indicate that word finding therapy can improve object naming in the treated language of bilinguals with aphasia. They also indicate that both L1 and L2 may be amenable to treatment, at least for some clients. Of the five participants who received therapy, three demonstrated overall significant improvement to items treated in English, while the noun naming of four participants significantly improved following treatment in Bengali. Indeed, given that several studies exploring the rehabilitation of bilingual aphasia have provided relatively weak evidence of outcomes to therapy, the current study has reported pre- and post-therapy assessment data and has clearly outlined the treatment that aphasic participants received. However, the performance of one of these participants indicated signs of spontaneous recovery; another failed to respond to treatment in either language. Naming improvements were typically item-specific; there was no evidence to suggest that any of the treatment had resulted in generalised gains (i.e. improvements to naming untreated items). This is comparable to some evidence from outcomes to word finding therapy with unilingual aphasic participants.

With the exception of the participant who indicated spontaneous recovery, cross-linguistic generalisation of gains in the treatment language to the untreated was very limited when the treated items (regardless of type of treatment) were analysed as a whole. However, a different pattern emerged when the nature of treatment (i.e. semantic versus phonological tasks) was taken into account. Consequently, the issue of cross-linguistic generalisation will be revisited in the following section.

9.3.3 Do therapy outcomes depend on the nature of the treatment?

This study provides evidence that bilingual clients with aphasia do respond differently to different types of treatment. This is perhaps surprising, given that the traditional distinction between semantic and phonological therapy has been questioned. Treatment studies of aphasia in bilinguals can offer a different perspective on how clients respond to treatment. Not only is it possible to measure any improvements to naming following different types of treatment, one can also explore

whether different types of treatment result in different patterns of cross-linguistic generalisation – a perspective not available in studies of unilingual people with aphasia.

Both semantic and phonological tasks were useful for at least some participants. Of the ten episodes of semantic therapy carried out, four (two in each language) resulted in significant improvements to naming treated items. There were more instances of phonological therapy effects. Of ten episodes of phonological treatment, seven (four in Bengali, three in English) resulted in significant improvements to naming treated items. However, all gains from semantic therapy remained significant at the maintenance assessment, whereas only four of the seven instances of phonological therapy effects were. These results appear to reinforce what might be considered the 'traditional' distinctions between semantic and phonological therapy: That both semantic and phonological therapies can improve noun naming but gains from semantic treatment might be more robust than those from phonological treatment.

The patterns of cross-linguistic generalisation of gains following therapy also indicate a difference between semantic and phonological therapy. Although phonological therapy was often effective (7/10 episodes led to significant improvements in the treated language), it gave rise to no significant cross-linguistic generalisation. Conversely, while semantic therapy resulted in significant improvements in only 4/10 episodes, in three instances there was significant generalisation to equivalent items in the untreated language. It may also be significant that no participant demonstrated significant cross-linguistic generalisation in both languages after semantic therapy. Indeed, in each case cross-linguistic generalisation was to the language rated weaker pre-morbidly (not necessarily L2). That is, only treatment in the participants' stronger language pre-morbidly led to cross-linguistic generalisation. This may have an impact on choosing a treatment language for SLT, but clearly this demands further exploration.

These results are consistent with models of bilingual language processing in which there is a common and central semantic system but distinct language-specific lexicons. If semantic processing is indeed centralised, one might expect gains from semantic therapy to generalise across languages. Conversely, gains from phonological therapy would be less likely to generalise cross-linguistically if phonological representations are language-specific, unless there were direct connections between lexicons in bilinguals. However, evidence from the assessment phase of the current study provided evidence in support of no direct connections between lexicons.

9.4 Implications for clinical practice

This study has resulted in the production of a valid, robust and reliable battery of word finding assessments that are suitable for use with Bengali-English bilinguals. Data have also been collected from the performance of people without brain injury; therefore clinicians will be able to use this test with aphasic clients from this population in clinical practice. The Bengali tests can also be carried out with unilingual Bengali speakers (or minimal bilinguals). This addressed a need faced by clinicians working in the catchment area of the funders of this study, Barts and the London NHS Trust, as no formal aphasia assessments were available to them despite the fact that a large proportion of their clients are members of London's Bengali community. Consequently, copies of the aphasia test battery developed in the study and corresponding control data have been made available to clinicians working in this area. The battery may also be of use to other clinicians working with members of this population.

This study has provided evidence of broadly positive outcomes of therapy targeting word finding in clients with bilingual aphasia. Clinicians will also note that the therapy tasks used to acquire these positive outcomes were the same as they are likely to implement with unilingual clients. There is currently little evidence to guide clinicians when choosing which language to initially treat with clients with bilingual aphasia. It would be very useful for clinicians if some evidence-based guidance was

available as potential prognosticators of therapy outcomes. Unfortunately, despite attempts in the current study to identify prognosticators of outcomes, the data add little to the debate. Although participants with the least severe aphasia benefited most from therapy, there was no evidence to indicate a relationship between naming scores (regardless of which language) and therapy outcomes (regardless of type of treatment). Furthermore, participants' responses to cueing during assessment were also not indicative of therapy outcomes.

In the current study, positive outcomes were achieved for some participants in both languages treated. Indeed, the number of therapy episodes that resulted in significant improvements to noun naming was broadly equal in both languages treated. However, clinicians should note that the only occurrences of cross-linguistic generalisation occurred in the language that participants rated their strongest pre-morbidly to their weaker language. Clinicians must remain pragmatic and patients' current language needs must be considered. Furthermore, as any improvements to word finding following treatment were item-specific, clinicians are advised to work on words that will be functionally useful for clients during therapy.

The data also indicate that clinicians should initially use a range of semantic and phonological tasks in treatment. For the participants in the current study, phonological therapy resulted in more language-specific improvements to naming, but although fewer episodes of semantic therapy were beneficial, only semantic therapy gains generalised to the untreated language. Gains from semantic therapy were also more robust. Clearly, clinicians need to initially explore different approaches to therapy with individual clients and assess outcomes before developing subsequent treatment.

The process of carrying out SLT through collaboration with non-specialist bilingual coworkers is an area that has received very little attention. This study has provided evidence of positive outcomes from therapy carried out in collaboration with bilingual coworkers. Given that improvements following treatment carried out in a client's pre-morbidly stronger language (often L1) may be more likely to generalise to

untreated languages, it is no longer acceptable to offer therapy in English on the grounds that that is the only language spoken by the SLT.

9.5 Directions for future research

The assessment and treatment of bilingual aphasia is an under-researched field and the exploratory nature of the current study has provided new evidence to contribute to our understanding of this area. It has also indicated areas for future research. However, as stated at the outset of this study, bilingual aphasia is a complicated area to explore effectively. Because of the exploratory nature of this research, it is necessary to clarify some limitations to the data and identify how this research might be developed.

The assessment phase resulted in a battery of tests suitable for Bengali-English bilinguals that are valid, robust and reliable. Control data from participants without brain injury have also been collected for some of the tests. Ensuring that tests designed for bilinguals are culturally relevant and contain items that are equally difficult across the test languages is a complex process. Meaningful psycholinguistic variables were not available during the development of the tests, but even if they were, it is unclear how these apply to bilingual populations. This study ensured that test items were of largely equal difficulty in the two languages by choosing targets with high name agreement and pair-matched latencies based on naming data from participants without brain injury. However, these latencies were much slower than anticipated. This discrepancy justifies further exploration. Would the latencies from another group of participants without brain injury from this population perform similarly? If so, it would be informative to explore why this is the case. Was it a result of a cultural misunderstanding, an aspect of bilingual processing, or perhaps simply a weakness in the methodology of the current study?

A recurring theme throughout this study has been the warning that caution must be taken when interpreting the data because of the small number of aphasic people who participated in the research. Clearly, one possibility for future research

would be to replicate the study with a larger number of aphasic participants. This applies to both the assessment and therapy phases of the study. However, much time and effort was spent on recruiting aphasic participants. This search focused on London boroughs that were known to be home to large numbers of people from the Bengali community, but others parts of England known to have large Bengali communities were also targeted. Despite this effort, only six aphasic people (with a wide range of aphasic impairments) consented to participate in the study. One might question how realistic it is to be able to develop this research with larger numbers of participants. However, as second and third generation migrants become older, the number of bilingual people from the Bengali community with aphasia is likely to grow very quickly. It may be the case that in a decade the demand for research in this area is much stronger because clinicians will be faced with larger numbers of Bengali clients with aphasia on their caseloads. Another possibility would be to carry out a similar methodology working with a different population of bilingual speakers.

Only the naming test was carried out twice with aphasic participants. T1 and T2 scores of aphasic participants on this test in both target languages were highly correlated, which suggests that the test is reliable when used with people with aphasia. It would be useful to establish how reliable other tests in the battery are. It would also be beneficial to acquire profiles of aphasic performance using the battery from a larger number of participants. The assessment data in the current study can only be indicative because of the small number of participants. Caution must be taken when interpreting the data, especially considering that of the six aphasic participants who completed the battery, two performed close to ceiling and another two close to floor.

The current study was unable to identify possible prognosticators of therapy outcomes based on assessment data (e.g. test scores or responses to cueing). However, identifying a significant correlation with such small numbers of participants was always unlikely. Little evidence is available to guide clinicians when choosing which

language to initially treat with clients with bilingual aphasia; therefore this is an area that justifies further exploration with larger numbers of participants.

The current study provides evidence of largely positive outcomes of SLT targeting word finding difficulties in bilingual clients with aphasia. Again, one must acknowledge the small number of participants, especially as one participant failed to respond to any treatment in either language and another demonstrated elements of spontaneous recovery. Certainly future studies of therapy outcomes would be stronger if blind assessments were carried out. In the current study, the same clinician and co-workers carried out both the testing and the therapy. Ideally, these roles should be separated to minimise potential researcher bias.

This study provided strong evidence that therapy delivered through non-specialist bilingual co-workers can be effective. However, it has been acknowledged that this success may have been because the therapy tasks were all highly prescribed, repetitive, and easily carried out. It would be interesting to explore outcomes of therapy carried out by bilingual coworkers (led by a SLT) using more complex tasks such as those targeting sentence processing or ones that required them to be more reactive to participants' responses.

Therapy was carried out in this study using two essentially unilingual paradigms (i.e. therapy in Bengali, therapy in English). Code-switching amongst bilinguals is entirely normal when they speak the same languages. Perhaps treatment could have been less language-specific and embraced the bilingualism of the participants. Indeed, all aphasic participants at some point were able to access the word in the non-target language but unable to do so in the target language. However, although a truly bilingual approach to treatment might be potentially beneficial to clients, this would not be clinically realistic (at least in the UK). The current study has reflected the clinical reality in the UK that most clinicians are unilingual English speakers. If SLT is to be carried out in another language, a coworker, interpreter, or family member must be brought in to assist. The methodology of the current study

reflects this situation. Where English is the predominant language used by clients, it is difficult to see how a bilingual ally might be brought in to work predominantly in English. In regions where bilingualism in particular languages is common (e.g. Spanish-English in Texas, French-English in parts of Canada), exploring a more fluid bilingual approach to SLT may be more realistic.

This study has focussed solely on the retrieval on nouns in bilingual aphasia. Indeed, this is also the case for most other studies exploring the treatment of bilingual aphasia. Exploring outcomes following therapy targeting noun production can be informative, but there is clearly a great deal more to communication than being able to produce imageable nouns. Future studies might explore how clients respond to therapy targeting verbs or sentence-level constructions. However, although it has proven possible to carry out research with bilinguals where the researcher does not speak one of the target languages in the current study, future research targeting verbs or more complex constructions would need to be carried out by a bilingual with high level abilities in the languages being explored.

Finally, this study has resulted in predominately quantitative data regarding outcomes of therapy. Given that this area of research has received relatively little attention, it would be informative also to acquire qualitative data concerning the participants' responses to and opinions about the treatment. For example, regardless of the quantitative data demonstrating improvements to word finding for some participants, did the participants themselves feel that they had improved, and if so, how (if at all) has this impacted on their quality of life? Indeed, a postgraduate student at City University is currently working on a project exploring exactly this by carrying out follow-up interviews with the aphasic participants and bilingual coworkers involved in the current study.

9.6 Final thoughts

This study has improved our understanding of anomia in one of the language minorities served by the Barts and the London NHS Trust, the funders of this research.

The project has resulted in the generation of new assessments of word finding suitable to be carried out with the Bengali community. These can be employed in future clinical practice. The study offers evidence of positive outcomes following word finding therapy. As RCSLT (2005) recognises that clients have a right to access therapy in their L1 when it is not English, this study demonstrates effective collaboration between a SLT and non-specialist bilingual coworkers. This can contribute to justifying the funding of bilingual support for SLT in addition to encouraging people from ethnic minority communities to join the profession.