

Reading second language subtitles:
A case study of South African viewers
reading in their native language and L2-English

Esté Hefer

**Reading second language subtitles:
A case study of South African viewers
reading in their native language and L2-English**

E Hefer

Thesis submitted for the degree Doctor of Philosophy in Language Practice
at the Vaal Triangle Campus of the North-West University

Promoter: Prof AJ van Rooy

Co-promoter: Prof JL Kruger

October 2011

ACKNOWLEDGEMENTS

I would like to sincerely thank the following people who helped me complete this study:

- My promoter, Prof Bertus van Rooy, for all the advice, encouragement and help, especially on matters regarding statistics and data analysis. I would still be wondering about the meaning of the “dirty” words (*p, t, f, s*) if it weren’t for you...
- My co-promoter, Prof Jan-Louis Kruger, for helping me with conceptual and subtitling-related matters, and above all for introducing me to the art of subtitling.
- Mr Martin Pötter, for the SMI iViewX™ training in Teltow, Berlin, during October 2009.
- Mr Thorsten Ahlrichs and the rest of the SMI support team in Teltow, for assisting me with technical matters and patiently helping me whenever I encountered problems with the eye-tracking system.
- The staff of the Vaal Triangle campus library, especially Mrs Yvonne Engelbrecht.
- Mrs Dine du Preez, for giving me access to the Academix™ software and reading material.
- The Director of Cavilam, Mr Michel Boiron, and the French Ministry of Foreign Affairs, for granting me permission to use the French short films in the publication of this study.
- Prof Susan Coetzee-Van Rooy, for sharing her insights and resources on multilingualism and bilingualism and for always being willing to lend a hand.
- Staff and friends within the Vaal Triangle Campus School of Languages, for helping me with the setup of the eye-tracking laboratory and volunteering as guinea pigs despite their own busy schedules.
- All the students who took the time to participate in the experiment – without you this study would not have been possible.
- The NWU, for giving me the financial means to complete my studies.
- My mother, Magriet, family and friends, for all the support and motivation, for keeping me going and for sharing in my joy and exhilaration.
- My housemates, Marli and Tania, for “keeping it real”.
- Ryno, for kind words, patience, unconditional love, support and understanding.
- Moe, for giving me a bird’s eye view on life.
- My Heavenly Father, for blessing me with an inquisitive mind...



ABSTRACT

Reading second language subtitles: A case study of South African viewers reading in their native language and L2-English

Most South African subtitles are produced and broadcast in English despite the fact that English is the first language of only 8.2% of the entire population (Statistics South Africa, 2004). Therefore, current English subtitles are predominantly received as second language text. This poses questions as to how people perceive these subtitles, and *if* and *how* their reading of English second language (L2) subtitles differs from their reading of L1 (non-English) subtitles.

In recent years, eye tracking has proven to be a valuable method in observing and measuring the eye movements of people watching and reading subtitles. In order to explain the use of eye tracking and in order to answer the question at hand, this study comprises a literature review and an empirical study. The literature review gives an in-depth account of previous studies that used eye tracking to study reading and elaborates on the parameters used to account for various findings. The two empirical components of this study examined the accessibility and effectiveness of English L2 subtitles by presenting native speakers of Afrikaans and Sesotho with subtitles displayed (a) in their native language, Afrikaans or Sesotho, and (b) in L2 English, while monitoring their eye movements with an SMI iViewX™ Hi-Speed eye tracker and comparing the data with that of English L1 speakers reading English subtitles. Participants were also given static text to read (accompanied by a corresponding comprehension test) in order to see if there was a relation between participants' first and second language reading of static text and that of subtitling. Additionally, participants were given a questionnaire on their reading behaviour, reading preferences, access to subtitled television programming and reading of subtitles in order to find explanations for occurrences in the data.

The initial hypothesis was that there would be a difference in L1 and L2 subtitle reading and attention allocation as measured by key eye-tracking parameters. Using ANOVAs, statistically significant differences were indeed found, but the differences were much more significant for the Sesotho L1 than the Afrikaans L1 speakers. After excluding possible confounding factors that were analysed in attempt to refute this hypothesis, the conclusion was that participants inherently read L1 and L2 subtitles differently. The hypothesis is therefore supported. However, the difference in L1 and L2 subtitle reading was not the only significant finding – the Sesotho L1

speakers' reading data revealed a greater underlying issue, namely literacy. The problem of low literacy levels can be attributed to the participants' socioeconomic background and history, and needs to be addressed urgently.

Recommendations for future research include that the current study be broadened in terms of scope, sampling size, representativeness and experimental material; that the focus be shifted to the rest of the languages spoken in South Africa for which the users do not have a shared sense of bilingualism and for which the L1 skills and levels of L1 literacy vary; and to further explore the relation between the reading of static text and subtitle reading in order to ensure adequate subtitle reading in terms of proportional attention allocation. However, the issue of low literacy levels will have to be addressed urgently; only then will the South African viewing public be able to gain full access to any form of broadcast communicative material or media, and only then will they be able to benefit from subtitling and all that it offers.

Key words: English second language (L2), subtitling, eye movements, eye tracking, reading behaviour, comprehension, attention allocation.

UITTREKSEL

Die lees van tweedetaalonderskrifte: 'n Gevallestudie van Suid-Afrikaanse kykers wat lees in hul moedertaal en tweedetaal Engels

In Suid-Afrika word die meeste onderskrifte tans in Engels geproduseer en uitgesaai ten spyte daarvan dat Engels as moedertaal deur slegs 8.2% van die bevolking gepraat word (Statistiek Suid-Afrika, 2004). Gevolglik word Engelse onderskrifte grotendeels as tweedetaalteks ontvang. Maar hoe ervaar mense hierdie onderskrifte? Lees hulle die Engels T2 onderskrifte anders as wat hulle (nie-Engelse) T1 onderskrifte sou lees? Indien wel, tot hoe 'n mate verskil hierdie lees?

Oor die afgelope paar jaar is oognaspeuring toenemend beskou as 'n waardevolle hulpmiddel in die waarneem en meet van oogbewegings van mense wat onderskrifte lees. Om die gebruik van oognaspeuring te verduidelik en die bogenoemde vraagstuk te beantwoord bestaan hierdie navorsing uit 'n literatuuroorsig sowel as 'n empiriese studie. Die literatuuroorsig bied 'n gedetailleerde oorsig oor vorige navorsing op die gebruik van oognaspeuring vir die bestudering van lees, en bied ook 'n breedvoerige bespreking van die parameters wat gebruik word om die verskeie bevindinge te verklaar. In die twee empiriese komponente van hierdie studie word daar ondersoek ingestel na die toeganklikheid en effektiwiteit van Engels T2 onderskrifte deur Afrikaans en Sesotho eerstetaalsprekers onderskrifte in onderskeidelik (a) hul moedertaal, Afrikaans of Sesotho, en (b) Engels as tweede taal te wys terwyl hul ogebewegings deurgaans deur middel van 'n SMI iViewX™ Hi-Speed oognaspeurder gemonitor word en hierdie data te vergelyk met Engels T1-sprekers se lees van Engelse onderskrifte. Daar is ook aan die deelnemers statiese teks (gepaardgaande met 'n ooreenkomstige begripstoets) gegee om te lees, ten einde te bepaal of daar 'n verband bestaan tussen deelnemers se eerste- en tweedetaalleesvermoëns vir die lees van statiese teks en die lees van onderskrifte. Deelnemers moes ook 'n vraelys voltooi wat handel oor hul leesgedrag, leesvoorkeure, toegang tot televisieprogramme met onderskrifte en hul houding jeens die lees van onderskrifte, ten einde verklarings te bied vir verskynsels in die data.

Die aanvanklike hipotese was dat daar 'n verskil in die lees van T1 en T2 onderskrifte asook verskille in die verdeling van aandag sou wees. Deur middel van ANOVAs is daar statisties beduidende verskille waargeneem, maar die verskille was omvangryker vir die Sesotho T1 sprekers as vir die Afrikaans T1 sprekers. Nadat die invloed van addisionele faktore uitgeskakel

is, is die uiteindelijke gevolgtrekking dat deelnemers inherent anders lees aan T1 as T2 onderskrifte. Die hipotese word dus ondersteun. Die verskil in die lees van T1 en T2 onderskrifte is egter nie die enigste beduidende bevinding nie – vanuit die Sesotho T1 sprekers se leesdata het 'n groter onderliggende probleem na vore getree, naamlik geletterdheid. Die probleem van lae geletterdheid kan toegeskryf word aan die sosio-ekonomiese agtergrond en geskiedenis van die deelnemers, en moet dringend aangespreek word.

Voorstelle vir verdere navorsing sluit onder meer in dat die huidige studie uitgebrei word in terme van die omvang daarvan, proefnemingsgrootte, veralgemeenbaarheid en eksperimentele materiaal; dat die fokus verskuif word na die res van die tale wat in Suid-Afrika gepraat word waarvoor daar nie 'n gedeelde tweetaligheid onder die gebruikers bestaan nie en waarvoor die T1 vaardighede en geletterdheidsvlakke verskil; en om verdere ondersoek in te stel na die verband tussen die lees van statiese teks en onderskrifte ten einde te verseker dat doeltreffende lees geskied in terme van proporsionele aandagverdeling. Die probleem van lae geletterdheidsvlakke moet egter dringend aangespreek word; slegs dan sal die Suid-Afrikaanse kykersgehoor ten volle toegang kan geniet tot enige vorm van kommunikatiewe uitsaaimateriaal of media, en slegs dan sal hulle kan baat vind by die lees van onderskrifte en alles wat daarmee saamgaan.

Sleuteltermes: Engels tweede taal (T2), onderskrifte, oogbewegings, oognaspeuring, leesgedrag, begrip, aandagverdeling

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION, CONTEXTUALIZATION AND PROBLEM

STATEMENT	1
1.1 Subtitles in South Africa.....	1
1.2 Reading English as a second language	4
1.3 Bilingualism in South Africa	5
1.4 The use of eye-tracking technology.....	8
1.5 Central theoretical statements.....	9
1.6 Research questions	10
1.7 Research objectives	10
1.8 Approach	11
1.8.1 Literature review	11
1.8.2 Empirical research.....	12
1.9 Ethical considerations.....	13
1.10 Chapter division and outline.....	14

CHAPTER 2: EYE TRACKING AS A METHOD TO STUDY READING AND

SUBTITLING	17
2.1 Terminology	17
2.1.1 Reading.....	17
2.1.2 Fixations	18
2.1.3 Saccades	20
2.1.4 Smooth pursuit	20
2.1.5 Gaze path.....	21
2.1.6 Regions of view.....	22
2.1.7 Other measures of importance.....	23
2.2 Good vs. bad reading	24
2.2.1 Variables that influence eye movements during reading	25
2.2.2 Eye movements, textual complexity and comprehension	29
2.3 Normal vs. subtitle reading.....	33
2.3.1 Attention allocation in reading.....	34
2.3.2 Eye movements during subtitle reading.....	38

2.3.3	The six-second rule for subtitle presentation	41
2.4	Reading subtitles in different languages	43
2.4.1	Reading foreign language subtitles	44
2.4.2	Reading L1 and L2 subtitles	46
2.4.3	The benefits and drawbacks of reading subtitles	48
2.5	Limitations of eye tracking and previous studies	52
2.6	Conclusion.....	55
CHAPTER 3: METHODOLOGY.....		59
3.1	Introduction	59
3.2	Setting.....	60
3.3	Participants	61
3.3.1	Sampling	61
3.3.2	Participant demographics	63
3.4	Materials.....	63
3.4.1	Static text.....	63
3.4.2	Subtitled short film.....	64
3.4.3	Questionnaire	69
3.5	Eye-tracking system	70
3.5.1	Hi-Speed camera	70
3.5.2	SMI Experiment Center™ 2.5	74
3.5.3	SMI BeGaze™ 2.5	75
3.6	Data collection / Procedure	78
3.6.1	Preliminary.....	78
3.6.2	Reading of static text.....	78
3.6.3	Subtitled short film.....	80
3.6.4	Questionnaire	81
3.7	Data analysis.....	81
3.7.1	Primary data: subtitle reading	81
3.7.2	Secondary data: confounding variables	84
3.7.2.1	Reading of static text.....	86
3.7.2.2	Questionnaire	87
3.8	Conclusion.....	89

CHAPTER 4: ANALYSIS AND INTERPRETATION OF EMPIRICAL FINDINGS

	FOR AFRIKAANS L1 SPEAKERS	91
4.1	Introduction	91
4.2	Participant demographics	92
4.3	Primary data: Reading subtitles	93
4.3.1	Difference between the reading of 1-line and 2-line subtitles	94
4.3.2	One-line subtitles.....	99
4.3.2.1	Absorption.....	99
4.3.2.2	Vertical movement	101
4.3.3	Two-line subtitles.....	104
4.3.3.1	Absorption.....	104
4.3.3.2	Vertical movement	107
4.3.4	Conclusion.....	109
4.4	Secondary data: Confounding variables	111
4.4.1	Reading speed for static text	111
4.4.1.1	Correlation between reading speed and subtitle reading.....	115
4.4.1.2	Correlation between reading comprehension and subtitle reading	122
4.4.1.3	Conclusion.....	124
4.4.2	Subtitle length	126
4.4.2.1	Correlation between subtitle length and subtitle reading.....	126
4.4.2.2	Conclusion.....	128
4.4.3	Questionnaire data.....	128
4.4.3.1	Reading habit.....	129
4.4.3.2	Subtitle reading habit	130
4.4.3.3	Television viewing habit	131
4.4.3.4	Like to watch local soap operas	132
4.4.3.5	Like to watch imported soap operas.....	133
4.4.3.6	Prefer local television programmes with or without subtitles.....	134
4.4.3.7	Prefer imported television programmes with or without subtitles	134
4.4.3.8	L2 subtitle reading habit.....	135
4.4.3.9	Like to read television subtitles.....	136
4.4.3.10	Conclusion.....	137
4.5	Conclusion.....	139

CHAPTER 5: ANALYSIS AND INTERPRETATION OF EMPIRICAL FINDINGS	
FOR SESOTHO L1 SPEAKERS	145
5.1 Introduction	145
5.2 Participant demographics	146
5.3 Primary data: Reading subtitles.....	148
5.3.1 Difference between the reading of 1-line and 2-line subtitles	149
5.3.2 One-line subtitles	154
5.3.2.1 Absorption.....	154
5.3.2.2 Vertical movement.....	159
5.3.3 Two-line subtitles.....	163
5.3.3.1 Absorption.....	163
5.3.3.2 Vertical movement.....	168
5.3.4 Conclusion	173
5.4 Secondary data: Confounding variables.....	175
5.4.1 Reading speed for static text	178
5.4.1.1 Correlation between reading speed and subtitle reading	182
5.4.1.2 Correlation between reading comprehension and subtitle reading	189
5.4.1.3 Conclusion	191
5.4.2 Subtitle length	193
5.4.2.1 Correlation between subtitle length and subtitle reading.....	193
5.4.2.2 Conclusion	194
5.4.3 Questionnaire data.....	194
5.4.3.1 Reading habit	195
5.4.3.2 Subtitle reading habit	196
5.4.3.3 Television viewing habit.....	197
5.4.3.4 Like to watch local soap operas	198
5.4.3.5 Like to watch imported soap operas	199
5.4.3.6 Prefer local television programmes with or without subtitles.....	200
5.4.3.7 Prefer imported television programmes with or without subtitles.....	202
5.4.3.8 L2 subtitle reading habit	203
5.4.3.9 Like to read television subtitles	203
5.4.3.10 Conclusion	204
5.5 Conclusion.....	206

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS	211
6.1 Introduction	211
6.2 Overview of the study.....	212
6.3 Summary of findings	214
6.3.1 Summary of findings for Afrikaans L1 speakers	215
6.3.2 Summary of findings for Sesotho L1 speakers	217
6.3.3 Discussion of overall findings and implications	219
6.4 Limitations.....	232
6.5 Recommendations for future research.....	234
6.6 Conclusion.....	237
BIBLIOGRAPHY	241
FILMOGRAPHY	255
APPENDIX A Afrikaans text for reading and comprehension.....	257
APPENDIX B Comprehension test for Afrikaans reading	261
APPENDIX C Sesotho text for reading and comprehension.....	265
APPENDIX D Comprehension test for Sesotho reading	271
APPENDIX E English text for reading and comprehension	277
APPENDIX F Comprehension test for English reading.....	283
APPENDIX G Complete questionnaire and consent form	287
APPENDIX H [DVD] Subtitled film shown to participants	309

LIST OF TABLES

Table 3.1	The language distribution of Afrikaans, English and Sesotho students on the Vaal Triangle Campus of the North-West University (NWU, 2010b).	p.60
Table 3.2	Hypothetical example: Crosstabulations of level of education for the respective groups based on the number of subtitles read per participant. The means are also given for dwell time and fixation time per category rated 1 (undergraduate) or 2 (postgraduate) as calculated by means of ANOVAs.	p.86
Table 4.1	The age and gender distribution of participants across the two test and two control groups.	p.92
Table 4.2	Comparison of findings for overall time spent reading one-line and two-line subtitles. These values were calculated by considering dwell time as a percentage of the total visible time of the respective one-line and two-line subtitles, regardless of language.	p.95
Table 4.3	Comparison of findings for time spent reading Afrikaans and English one-line and two-line subtitles. These values were calculated by considering dwell time as a percentage of the total visible time of the one-line and two-line subtitles per language group.	p.97
Table 4.4	Calculation of the time spent reading subtitles based on the visible time (VT) of the subtitles and participants' dwell time (DT) in the subtitles, using the duration of the film (starting when the first subtitle appeared and ending when the last subtitle disappeared).	p.98
Table 4.5	Means and standard deviations of the parameters indicating the processing difficulty (absorption) of one-line subtitles during the first half of the film.	p.99
Table 4.6	Means and standard deviations of the parameters indicating the processing difficulty (absorption) of one-line subtitles during the second half of the film.	p.100
Table 4.7	Means and standard deviations of the parameters indicating the vertical movements made when reading one-line subtitles for the first and second halves of the film.	p.102
Table 4.8	Means and standard deviations of the parameters indicating the processing difficulty (absorption) of two-line subtitles during the first half of the film.	p.104

Table 4.9	Means and standard deviations of the parameters indicating the processing difficulty (absorption) of two-line subtitles during the second half of the film.	p.105
Table 4.10	Means and standard deviations of the parameters indicating the vertical movements made when reading two-line subtitles for the first and second halves of the film.	p.107
Table 4.11	Results for the reading of static text and comprehension test(s). Reading speed was measured as words per minute (wpm) and the scores for the comprehension tests were calculated as a percentage mark.	p.113
Table 4.12	Comparative data of the reading skills of first-year students enrolled at the Potchefstroom campus of the North-West University (NWU, 2010c).	p.115
Table 4.13	Correlations between reading speed and all three parameters used to measure absorption.	p.116
Table 4.14	Correlations between reading speed and dwell time as a percentage of the visible time of the respective subtitle languages (per language overall and per group).	p.117
Table 4.15	Correlations between reading speed and the two parameters used to measure vertical movement.	p.118
Table 4.16	Imposed reading speed calculated according to the visible time and average word count of one-line and two-line subtitles per language group.	p.118
Table 4.17	Calculation of participants' actual reading speed per visible time (VT) of the subtitles and dwell time (DT) in the subtitles, using the duration of the film (starting when the first subtitle appeared and ending when the last subtitle disappeared).	p.119
Table 4.18	The estimated reading time per word calculated per language per group in milliseconds.	p.119
Table 4.19	A comparison of reading speed for static text (wpm) and subtitle reading (ms) as calculated for Afrikaans and English overall.	p.120
Table 4.20	A comparison of reading rate for static text and subtitle reading (wpm) as calculated for Afrikaans and English overall.	p.121
Table 4.21	Correlations between reading comprehension and dwell time as a percentage of the visible time of the respective subtitle languages (per language overall and per group).	p.122

Table 4.22	Correlations between reading comprehension and all three parameters used to measure absorption.	p.123
Table 4.23	Correlations between reading comprehension and the two parameters used to measure vertical movement.	p.124
Table 4.24	Correlations between word count and all three parameters used to measure absorption.	p.127
Table 4.25	Correlations between character count and all three parameters used to measure absorption.	p.127
Table 4.26	Crosstabulations of television viewing habits for the respective groups based on the number of subtitles read per participant. The means are also given for dwell time and fixation time per reading category rated from A (none to few times per week) to C (many times per week) as calculated by means of ANOVAs.	p.131
Table 4.27	Crosstabulations of participants' preference to watch imported television programmes with or without subtitles for the respective groups based on the number of subtitles read per participant. The means are also given for dwell time and fixation time per category rated from 1 (with subtitles) to 2 (without subtitles) as calculated by means of ANOVAs.	p.135
Table 4.28	Summary of the findings for the additional variables. Each variable represents the possibility of an alternative hypothesis that could refute the research hypothesis that subtitle reading differs for L1 and L2.	p.138
Table 5.1	The age and gender distribution of Sesotho L1-speaking participants across the test and control groups.	p.146
Table 5.2	Comparison of findings for overall time spent reading one-line and two-line subtitles. These values were calculated by considering dwell time as a percentage of the total visible time of the respective one-line and two-line subtitles, regardless of language.	p.150
Table 5.3	Comparison of findings for time spent reading Sesotho, Afrikaans and English one-line and two-line subtitles. These values were calculated by considering dwell time as a percentage of the total visible time of the one-line and two-line subtitles per language group.	p.152
Table 5.4	Calculation of the time spent reading subtitles based on the visible time (VT) of the subtitles and participants' dwell time (DT) in the subtitles, using the duration of the film (starting when the first subtitle appeared and ending when the last subtitle disappeared).	p.153

Table 5.5	Means and standard deviations of the parameters indicating the processing difficulty (absorption) of one-line subtitles during the first half of the film.	p.155
Table 5.6	Means and standard deviations of the parameters indicating the processing difficulty (absorption) of one-line subtitles during the second half of the film.	p.155
Table 5.7	Means and standard deviations of the parameters indicating the vertical movements made when reading one-line subtitles for the first and second halves of the film.	p.161
Table 5.8	Means and standard deviations of the parameters indicating the processing difficulty (absorption) of two-line subtitles during the first half of the film.	p.164
Table 5.9	Means and standard deviations of the parameters indicating the processing difficulty (absorption) of two-line subtitles during the second half of the film.	p.164
Table 5.10	Means and standard deviations of the parameters indicating the vertical movements made when reading two-line subtitles for the first and second halves of the film.	p.170
Table 5.11	Results for the reading of static text and comprehension test(s). Reading speed was measured as words per minute (wpm) and the scores for the comprehension tests were calculated as a percentage mark.	p.179
Table 5.12	Comparative data of Sesotho L1-speaking participants' reading skills for Sesotho and English static text reading measured in terms of their reading speed (words per minute) and comprehension scores (percentage value).	p.181
Table 5.13	Correlations between reading speed and all three parameters used to measure absorption.	p.183
Table 5.14	Correlations between reading speed and dwell time as a percentage of the visible time of the respective subtitle languages (per language overall and per group).	p.184
Table 5.15	Correlations between reading speed and the two parameters used to measure vertical movement.	p.184
Table 5.16	Imposed reading speed calculated according to the visible time and average word count of one-line and two-line subtitles per language group.	p.185

Table 5.17	Calculation of participants' actual reading speed per visible time (VT) of the subtitles and dwell time (DT) in the subtitles, using the duration of the film (starting when the first subtitle appeared and ending when the last subtitle disappeared).	p.186
Table 5.18	The estimated reading time per word calculated per language per group in milliseconds.	p.186
Table 5.19	A comparison of reading speed for static text (wpm) and subtitle reading (ms) as calculated for English overall.	p.188
Table 5.20	A comparison of reading rate for static text and subtitle reading (wpm) as calculated for English overall.	p.189
Table 5.21	Correlations between reading comprehension and dwell time as a percentage of the visible time of the respective subtitle languages (per language overall and per group).	p.190
Table 5.22	Correlations between reading comprehension and all three parameters used to measure absorption.	p.190
Table 5.23	Correlations between reading comprehension and the two parameters used to measure vertical movement.	p.191
Table 5.24	Correlations between word count and all three parameters used to measure absorption.	p.193
Table 5.25	Correlations between character count and all three parameters used to measure absorption.	p.193
Table 5.26	Crosstabulations of participants' preference to watch local television programmes with or without subtitles for the respective groups based on the number of subtitles read per participant. The means are also given for dwell time and fixation time per category rated from 1 (with subtitles) to 2 (without subtitles) as calculated by means of ANOVAs.	p.201
Table 5.27	Summary of the findings for the additional variables. Each variable represents the possibility of an alternative hypothesis that could refute the research hypothesis that subtitle reading differs for L1 and L2.	p.205
Table 6.1	Preliminary findings for the distribution of attention between the subtitled area and the rest of the images (visuals) on the screen as found for different viewing speeds, taken from Romero-Fresco (forthcoming, 2011:24).	p.227
Table 6.2	Suggested optimised viewing speeds for the equal distribution of attention between the subtitled area and the rest of the images (visuals) on the screen based on the findings of the current study.	p.228

LIST OF FIGURES

- Figure 2.1** “The Input Processing of Multichannel Feeds Including Grimes’ (1991) Attention Moderator Construct”, taken from Guillory (1998:96). p.51
- Figure 3.1** Screenshots of the short film, *Tadeus*, containing separate Afrikaans, English and Sesotho subtitles. p.66
- Figure 3.2** The reading speed indicator in Cavena Tempo indicating (a) too little reading time, (b) adequate reading time, and (c) too much reading time, calculated in terms of the presentation time of the subtitles (indicated by the arrows) and the number of characters in each respective subtitle p.67
- Figure 3.3** Afrikaans, English and Sesotho subtitles marked as areas of interest (AOIs) by means of coloured, semi-transparent blocks. p.68
- Figure 3.4** Screenshot of what the researcher sees when regulating the accuracy of the eye tracker during the viewing of the preliminary subtitled film clip. The green dot indicates the correct positioning of a participant’s eye; the blue and orange dots indicate inaccurate positioning. p.69
- Figure 3.5** The SMI iViewX™ Hi-Speed eye-tracking column as seen from (a) the front, (b) the back, and (c) focusing on the view aperture with the chin and forehead rest (SMI, 2009a:186-188). p.71
- Figure 3.6** Screenshots of an inaccurate calibration (left) followed by a subsequent accurate calibration (right). p.73
- Figure 3.7** Screenshot of the Experiment Center 2.5 user interface showing (a) the different stimuli options that can be inserted into an experiment, (b) the stimuli selected for the Afrikaans control group (CAA) including the compulsory calibration (marked in yellow), and (c) calibration settings. p.75
- Figure 3.8** Screenshot of the BeGaze 2.5 user interface showing (a) the different smart visualization options, (b) an area of interest tab opened for creating and editing areas of interest, and (c) a subtitle marked as an AOI. p.76
- Figure 3.9** Screenshots of a heat map video (left) and a focus map video (right) indicating where participants focused during viewing of the subtitled film. p.76

Figure 3.10	Screenshots of a scan path video indicating the order in which a participant read a subtitle by means of fixations (circles) and saccades (connection lines). The longer the fixation duration, the bigger the circle.	p.77
Figure 3.11	A participant seated at the Hi-Speed eye tracker in front of the stimulus screen.	p.79
Figure 4.1	Graphs indicating the non-linear interaction of participants' reading habit with dwell time (left) and fixation time (right).	p.129
Figure 4.2	Graphs indicating the reversed linear interaction of participants' subtitle reading habit with dwell time (left) and fixation time (right).	p.130
Figure 4.3	Graphs indicating the linear interaction of participants' television viewing habit with dwell time (left) and fixation time (right).	p.131
Figure 4.4	Graphs indicating the semi-linear, reversed interaction of participants' liking of local soap operas with dwell time (left) and fixation time (right).	p.132
Figure 4.5	Graphs indicating the non-linear interaction of participants' liking of imported soap operas with dwell time (left) and fixation time (right).	p.133
Figure 4.6	Graphs indicating the linear interaction of participants' preference to view imported television programmes with or without subtitles with dwell time (left) and fixation time (right).	p.134
Figure 4.7	Graphs indicating the reversed linear interaction of participants' L2 subtitle reading habit with dwell time (left) and fixation time (right).	p.136
Figure 4.8	Graphs indicating the non-linear interaction of participants' liking of television subtitles with dwell time (left) and fixation time (right).	p.137
Figure 5.1	Screenshots of unfinished subtitle reading by Sesotho L1-speaking participants when reading one-line Sesotho subtitles. The screenshots were taken on the last visible frame before the subtitle was taken off-screen.	p.187
Figure 5.2	Screenshots of unfinished subtitle reading by Sesotho L1-speaking participants when reading two-line Sesotho subtitles. The screenshots were taken on the last visible frame before the subtitle was taken off-screen.	p.187
Figure 5.3	Graphs indicating the linear interaction of participants' reading habit with dwell time (left) and the reversed linear interaction with fixation time (right).	p.196

- Figure 5.4** Graphs indicating the reversed linear interaction of participants' subtitle reading habit with dwell time (left) and the semi-linear, reversed interaction with fixation time (right). p.197
- Figure 5.5** Graphs indicating the non-linear linear interaction of participants' television viewing habit with dwell time (left) and the reversed linear interaction with fixation time (right). p.198
- Figure 5.6** Graphs indicating the semi-linear, reversed interaction of participants' liking of local soap operas with dwell time (left) and the non-linear interaction with fixation time (right). p.199
- Figure 5.7** Graphs indicating the semi-linear, reversed interaction of participants' liking of imported soap operas with dwell time (left) and the reversed linear interaction with fixation time (right). p.200
- Figure 5.8** Graphs indicating the linear interaction of participants' liking of imported soap operas with dwell time (left) and fixation time (right). p.201
- Figure 5.9** Graphs indicating the reversed linear interaction of participants' preference to view imported television programmes with or without subtitles with dwell time (left) and fixation time (right). p.202
- Figure 5.10** Graphs indicating the reversed linear interaction of participants' L2 subtitle reading habit with dwell time (left) and fixation time (right). p.203
- Figure 5.11** Graphs indicating the non-linear interaction of participants' liking of television subtitles with dwell time (left) and fixation time (right). p.204

*The transformational butterfly-effect for literacy is not the writing
on the wall, it is a subtitle on television.*
(Kothari *et al.*, 2002)

CHAPTER 1

Introduction, contextualization and problem statement

1.1 SUBTITLES IN SOUTH AFRICA

Like many other countries, South Africa imports a number of television programmes from abroad. In addition, an increasing number of programmes are being produced locally. While this boosts the local morale by creating a sense of accomplishment and boosting the local film and television production industry, it also presents a number of logistic challenges. The material produced is often not accessible to the majority of the South African viewing public because of language barriers and the lack of sufficient (if any) subtitles.

South Africa is a multilingual, multicultural country with a wide range of spoken language varieties, 11 of which have been granted official status by the Constitution of South Africa (Act 108 of 1996, section 6), namely Sepedi (*Northern Sotho*), Sesotho (*Southern Sotho*), Setswana (*Tswana*), siSwati (*Swati*), Tshivenda (*Venda*), Xitsonga (*Tsonga*), Afrikaans, English, isiNdebele (*Ndebele*), isiXhosa (*Xhosa*) and isiZulu (*Zulu*). Despite the fact that the Constitution makes provision for the equality of these languages¹, and also despite the fact that English is the first language of only 8.2% of the entire population (Statistics South Africa, 2004:8), English is considered the *lingua franca* in South Africa (Deprez & Du Plessis, 2000). The implication of this is that there are many languages that are under-developed in terms of lexicon and there is limited material available for the speakers of these languages. Consequently, limited literacy levels are reported in many of the official languages. Nevertheless, due to the status of English in South Africa, it is often expected that everybody is able to function in English. Most communities do this by adapting the language according to their needs and making it their own. As Kamwangamalu (2007:264) states, “the identities of English in South Africa are community-specific in the sense that English evokes differing reactions in the different South African language communities.” In other words, how one community perceives and uses English might be completely different from other communities.

¹ According to the Constitution of South Africa Act 108 of 1996, Act 6 (4) “all official languages must enjoy parity of esteem and must be treated equitably”.

Chapter 1: Introduction, contextualization and problem statement

Multilingual countries like South Africa face a number of challenges in terms of language management. Two areas that are affected by this the most are education and entertainment, where different language groups often do not share equal access to materials in their respective languages. Technology in the form of subtitling could provide some support in multilingual countries to deal with these challenges in an effective manner by providing subtitles in a multitude of languages and thus giving all language groups the opportunity to access materials in the language of their choice. However, technological aids are not always exploited to their fullest potential, as is the case in South Africa. English has the most airtime on South African television – in 2001 it was found that English took up a total of 85% of airtime across the three public channels broadcast by SABC TV (South African Broadcasting Corporation), SABC1, SABC2 and SABC3 (Kamwangamalu, 2007:267). Currently, most South African subtitles are produced in English, with the exception of a few programmes sporadically subtitled into Afrikaans. Most of the programmes imported from abroad display English subtitles too, if subtitled at all. The de facto convention for South African public television is that most programming is in English and that those programmes that are not in English should be subtitled into English.

These English subtitles are predominantly received as second language text.² In South Africa it has been noted that second and third language speakers of English typically overestimate their proficiency in this language. In 2000, Coetzee-Van Rooy and Verhoef found that Southern Sotho speakers who speak English as a second language regarded themselves as “successful or very successful at speaking, writing, reading and understanding English” (Coetzee-Van Rooy & Verhoef, 2000:173), while tests showed that they achieved low English second language scores. Although based on the findings for one language group, Coetzee-Van Rooy and Verhoef (2000:175) argue that “this finding seems to confirm the perceptions of teachers and researchers that the English second language proficiency levels of South Africans are low and, in general, does not empower them for sufficient access to certain domains”. This holds serious implications as “the demands of interlingual communication in South Africa far exceed the levels of people’s proficiency in English” (PANSALB, 2006:14). This situation exacerbates challenges related to subtitling in South Africa.

² Coetzee-Van Rooy (2010a:3) states the following regarding the users of English: “One of the most striking features of the spread of English noted by linguists is the awareness that users of English as an additional language outnumber users of English as a home language.”

Chapter 1: Introduction, contextualization and problem statement

Literacy is a critical issue that comes into play here. According to Trading Economics (2011) in 2008 the adult literacy rate in South Africa was estimated at 89% (males: 89.9%; females: 88.10%). The same rate is stated by UNICEF (2010) for the period of 2005-2008. Human Development Reports (2009), in turn, estimates the South African illiteracy rate at 12%. However, there are some questions as to the calculation of these estimates. According to Posel (2011:41), “[i]n South Africa, ‘functional literacy’ has typically been defined as the completion of at least a Grade 6 or Grade 7 education, although in some studies it is identified as low as Grade 3 [...] However, a problem with this method of measuring literacy is that years of completed schooling may not translate into reading and writing skills that are commensurate with the level of education.” Furthermore, the notion of literacy should be considered as more than the mere ability to read and write in a language, which is what some surveys measure by asking participants’ to rank their own ability to perform these tasks. The implication of this is that the estimated levels of adult literacy might not be an accurate reflection of true national literacy but rather of people’s perceptions of themselves and their abilities – people may be able to read, but that does not necessarily mean that they are good readers. In fact it has been found that learners at both school and tertiary level perform below expectation in terms of reading (Pretorius, 2000; Macdonald, 2002; Department of Education, 2003; Nel *et al.*, 2004; Pretorius & Mampuru, 2007; Pretorius, 2010). From this one can only imagine the estimations for L2 literacy.

The low literacy level puts South Africa and the needs of the South African viewing public apart from other countries where subtitling is already an accepted practice, and is one of the reasons why one should view existing subtitling norms with care. As Kruger, H.C. (2004:37) puts it:

[M]ost existing subtitling theory has been formulated in developed countries. [...] Apart from the economic differences between developed and developing countries, there are also marked differences in social development between the populations of developed and developing countries, notably in terms of literacy. This means that the viewer population and the national context of subtitling in a developing country will be different to that of a developed country.

Literacy levels in a community are viewed as a continuum where different members of a society display different degrees of literacy, and whether a community is fully illiterate, partly literate or adequately literate should be taken into account when one considers subtitling arrangements. Apart from literacy as the ability to read and write, the question as to whether and to what extent a community is subtitle literate (how competent, knowledgeable and familiar they are with

reading subtitles) is an additional determining factor in producing subtitles for that community. Therefore it cannot be assumed that guidelines created for a specific community (regarding style, standards, volume, speed) can necessarily be applied to another community in its original form.

Added to the matter of subtitles being presented and read predominantly as second language text, it becomes evident that the current state of subtitling in South Africa needs to be addressed urgently in terms of style, readability and efficiency. Before this can be done, however, a critical question has to be answered, namely *how* the reading of subtitles differs when reading in one's native language as opposed to reading in English as a second language.

1.2 READING ENGLISH AS A SECOND LANGUAGE

Broadly speaking, English can be classified in three ways: as a native language (ENL), a second language (ESL), or a foreign language (EFL) (Jenkins, 2003:14).³ Another way of viewing English is in terms of Kachru's concentric circles (1992), the "Inner Circle" constituting the ENL countries, the "Outer Circle" the ESL countries, and the "Expanding Circle" the EFL countries (Jenkins, 2003:15). According to Kamwangamalu (2007:264) English in South Africa "belongs to two of the three concentric circles [...], the Inner Circle and the Outer Circle; that is, English is used as a native language by some and as a second language by others", with the majority of South Africans being second language users of English.

In her study on L1 and L2 reading, Brisbois (1995:582) emphasizes that "L1 reading ability needs to be tested to gain insight into learner difficulties in L2 study [...] L1 reading skill has been identified as an important predictor of L2 reading ability". Although this is directed at educational instruction rather than general reading, it is still significant in that a definite relation between L1 and L2 reading is postulated. Bernhardt and Kamil (1995:15) pose important questions on the second language reading process, namely "How L1 literate does a second language reader have to be to make the second language knowledge work?" and "How much second language knowledge does a second language reader have to have in order to make the L1 literacy knowledge work?" After analysing the experimental data from 186 adult native English

³ The classifications of ENL, ESL and EFL have intricate and varying descriptions based on factors that do not fall within the scope of this study. These classifications are mentioned here for the sole purpose of illustrating the different world views of English.

Chapter 1: Introduction, contextualization and problem statement

speakers reading in English and Spanish, Bernhardt and Kamil (1995:31) came to the following conclusion:

[H]owever no matter how proficient they appeared to be [*in reading Spanish second language*], there were micro-level features of language that caused difficulty. This phenomenon underlines that second language reading is not merely an impoverished version of L1 reading, but that it is indeed a process that requires some unique reading capacities and lexical and grammatical flexibility.

An additional complexity is introduced when reading subtitles. Reading subtitles differs from reading static text because more than one mode of input is involved: viewers hear the soundtrack, see the visual presentation, and read the subtitles. Chai and Erlam (2008) studied the effects and influence of video and subtitles on second language learning and found that, within the L2 context, “[r]esearch has shown an impact on reading and listening comprehension, listening and word recognition, as well as incidental vocabulary learning.” (Chai and Erlam, 2008:26). Chai and Erlam (2008:27) also acknowledge the difficulties related to reading L2 subtitles by calling the experience of reading subtitles in an L2 “another matter” altogether. However, although listing possible disadvantages of using subtitled videos in a language learning context, no reference is made to the complications of L2 subtitle reading itself apart from the fact that students learned certain phrases because they knew the words and that there were clear contextual and/or co-textual cues (Chai & Erlam, 2008:35). There is therefore a definite need for improved guidelines and possible alternatives or suggestions for problems regarding L2 subtitle reading.

1.3 BILINGUALISM IN SOUTH AFRICA

Within South Africa’s multilingual context, a unique relationship exists between Afrikaans and English in terms of user proficiency. Coetzee-Van Rooy refers to this as “[t]he well-known phenomenon of Afrikaans/English bilingualism” (Coetzee-Van Rooy, 2010a:15). This phenomenon pertains to the fact that Afrikaans L1 speakers have a high level of proficiency in L1 Afrikaans and English as their second language to the extent that they are near or fully bilingual.

Afrikaans/English bilinguals form part of a unique group in South Africa. Firstly, they have the choice to be educated from primary school to university in their L1 and are, from an early age,

Chapter 1: Introduction, contextualization and problem statement

exposed to both their first (L1) and second (L2) languages in domestic and educational environments. This is as opposed to native speakers of African languages who are not – they are typically put in Afrikaans or English schools where they are “forced” to start learning and reading in a language which is either their L2 or another additional language before perfecting these skills in their L1. Put differently – in most educational environments, speakers of native African languages never fully learn to read and write in their L1 before moving on to learning these skills in an L2 or another additional language.⁴ Research has shown that children who learn to read in their home language benefit more in terms of reading and exceed more in their L2 English reading than do children who immediately start reading in L2 English (Pretorius & Mampuru, 2007:39). Therefore, instead of benefitting the reader in terms of early exposure to the L2, the omission of the foundation of L1 learning has been proven to be detrimental to the learner’s actual L2 or additional language reading ability. This issue is not only limited to South African schools or educational environments:

The African continent is characterised by linguistic diversity but due to its colonial past, the majority of learners in Sub-Saharan Africa do not do their schooling in their home language but through the medium of a former colonial language. If schooling does occur in the home language, it does so for a few years only, before switching to the former colonial language.

(Pretorius & Mampuru, 2007:38)

Coetzee-Van Rooy (2010a:16) acknowledges this issue by stating that “[w]e [...] know the indigenous languages are not afforded formal or high status in schools”.

A second factor favouring Afrikaans/English bilinguals is that they usually attend well-managed schools. Jansen (2009) makes numerous references to the fact that Afrikaans schools are well-organized and well-managed, providing “a strong and holistic education” through academic, cultural and sporting activities (Jansen, 2009:14). Regarding matters like orderliness and discipline, Jansen (2009:105) comments that Afrikaans schools “are light years removed from ordinary township schools or from many of the English-medium schools”. According to Jansen (2009:19,98) this learning environment is boosted by the intense and direct involvement of both parents and teachers. In this setting, learning becomes an “affirming experience” (Jansen,

⁴ Pretorius and Mampuru (2007:40) comment on this matter by stating that: “Although initial schooling in the home language is encouraged by the Department of Education, school governing bodies have a choice and can opt for a ‘straight for English’ policy. Because English is regarded as the language of status, opportunity and education, the misperception often persists among parents that primary schools that offer ‘straight for English’ will provide a good education for their children.”

Chapter 1: Introduction, contextualization and problem statement

2009:100), which in turn most likely affects the extent to which students are willing (and eager) to learn new things such as an additional language. In stark contrast to this, “poorly resourced schools, inappropriate instructional methods, print-poor environments, overcrowded classrooms, reduced time-on-task and poorly trained teachers” have all been sighted as factors that negatively influence literacy in African languages, as was found in studies on the literacy of African home languages (Pretorius & Mampuru, 2007:40). Lastly, and probably due to the before-mentioned reasons, the English L2 teaching at Afrikaans schools is of high quality. Afrikaans/English bilinguals therefore have the opportunity to develop into balanced bilinguals and to develop literacy in two languages equitably.

The combination of Afrikaans and English was chosen for the first component of the current study for precisely this reason. What is important here, however, is not necessarily the bilingualism but rather the means and extent to which these Afrikaans/English bilinguals develop their linguistic skills, particularly their reading skills and proficiency. Although it may be argued that there is no real significance in examining Afrikaans versus English reading because of participants’ high level of proficiency in both these languages, it should be noted that L1 and L2 reading will always differ to some extent and that these differences are still of importance – if this group, who is highly proficient in L2 English, has trouble reading the L2 subtitles, then one can be certain that other groups who do not share this level of bilingualism will struggle even more. This component of the current study was therefore taken as the starting point for research of this nature.

African languages, in turn, are unique in terms of acquisition – when children enter the school system they learn English and develop skills in how to use English even though, for them, English is usually not their first or even their second language. This means that English, through increasing attention, often becomes their stronger language (stronger than their home language in an academic context). Afrikaans is more typical in this regard, as the home language receives constant and thorough attention and forms the basis of literacy. The difference between using Afrikaans or a native African language in comparison with L2 English therefore rests on the fact that speakers of Afrikaans have a strong foundation in their L1 on which their learning, development and use of L2 English is based, which is not case with most native African languages. The question to be asked, therefore, is how and to what extent this influences their reading of L2 English text, and how this reading compares to their L1 reading. The exploration

of this matter constitutes the second component of the current study, with Sesotho as the African language to be explored.

1.4 THE USE OF EYE-TRACKING TECHNOLOGY

In recent years eye tracking has proven to be a valuable method of observing and measuring the eye movements of people watching and reading subtitles. In general, eye movements are one of the best ways to study language comprehension processes (Pollatsek & Rayner, 2006:613). It is a way in which to gain insight into the inner workings of the mind by simply observing the eye, its movements and the finer characteristics thereof. This unique method becomes even more significant when applied to the field of audiovisual translation and subtitling, where reading is not merely reading but one of three events that have to occur simultaneously in order to comprehend all that is offered: reading, watching, and listening. The importance of eye movement analysis lies in the fact that, although it explains only a small part of the complex process of reading, it indicates how people visually process written text and is a significant source of information on how people actually “read” in practice (De Linde & Kay 1999:59). According to De Linde and Kay (1999:18) “eye-movements are a critical factor in determining how well a viewer participates in a subtitled programme”.

Some of the most important data gathered from eye tracking are derived from analysing fixation duration and saccade size, where a fixation is defined as a period of time when the eyes are relatively still and during which “new visual information is encoded from the text” (Pollatsek & Rayner, 2006:614). One extremely important finding in studies of eye movements and reading is that the duration of a fixation on a word (i.e. how long a person focuses on a specific word) is associated with the degree of ease or difficulty of understanding a word during reading (Just & Carpenter, 1980; Praet *et al.*, 1990; McConkie & Yang, 2003; Morris & Williams, 2003; Liversedge *et al.*, 2004; Pollatsek & Rayner, 2006; d’Ydewalle & De Bruycker, 2007; Perego, 2008; SMI, 2009b). Saccades, in turn, are the rapid movements made by the eye in between fixations. In this regard, Pollatsek and Rayner (2006:615) have found that:

The variability that exists in both fixation duration and saccade size is related to processing activities: when text is difficult, readers make longer fixations and shorter saccades. Furthermore, when text is difficult, readers move their eyes backwards in the text (*regressions*).

Chapter 1: Introduction, contextualization and problem statement

According to d’Ydewalle and De Bruyker (2007:196), switching attention from the visual image on-screen to the subtitle region and “reading” the subtitles happens “effortlessly and almost automatically”. Does this imply automatic reading as well? How is the reading influenced by the fact that the rapidly presented subtitles are received as second language text? The value of eye tracking in these matters is that “[b]y analyzing optic pauses and regressions, and monitoring the pace of reading, detailed information can be obtained about the viewing process” (De Linde & Kay, 1999:37).

Pollatsek and Rayner (2006:621-628) make note of certain variables that influence word recognition and eye movements. These include word difficulty, contextual constraints, number of meanings (lexical ambiguity), phonological coding, semantic relationships between words and morphological effects. However, when combined with other visual material like images or film as in subtitling, these variables are no longer the only constraints – now the eye has to move, not only between words and sentences, but between the text and the rest of the visuals on-screen. Attentional demands therefore increase as information has to be gathered from both channels.

If verbal information is added to some visualization (illustration, graph, etc.) in written form, both information sources must be processed by the visual processing channel. [...] Before integrating both sources, the source that was attended first must be held in active memory until the corresponding information in the second source is found and processed. The more information is held active or the more capacity is needed to search for corresponding information the more cognitive resources are occupied, resulting in a higher cognitive load.

(Schmidt-Weigand, 2009:91)

The complexity of incomplete chunks simultaneously held in short-term memory also affects attentional demand and cognitive load (Gibson, 1998), which undoubtedly has an effect on reading. The benefit of having eye-tracking technology is that today this no longer has to be an assumption – one can now study exactly how reading is affected.

1.5 CENTRAL THEORETICAL STATEMENTS

This study postulates that reading behaviour and reading speed differ for Afrikaans and Sesotho viewers reading L1 and English L2 subtitles when compared to English L1 speakers reading L1

subtitles.⁵ It is also postulated that the findings for this study could aid the production and improvement of L2 subtitles in South Africa for the various language groups through the creation and implementation of future guidelines.⁶

1.6 RESEARCH QUESTIONS

The focus of this study centred on three questions:

- Are there differences between L1 and L2 subtitle reading among Afrikaans L1, English L2 participants?
- Are there differences between L1 and L2 subtitle reading among Sesotho L1, English L2 participants?
- What are the implications of the findings for the improvement of subtitling in South Africa for these language groups, and how do the findings affect the creation and implementation of future guidelines aimed at aiding the production of L2 subtitles in South Africa?

1.7 RESEARCH OBJECTIVES

This study set out to examine the accessibility and effectiveness of English second language (L2) interlingual⁷ subtitles presented to Afrikaans first language (L1) and Sesotho first language (L1) users. The primary objectives of this study were as follows: (1) To determine the difference in Afrikaans viewers' reading of L1 and L2 subtitles in terms of their reading behaviour (eye movements) and reading speed; (2) to determine the difference in Sesotho viewers' reading of L1 and L2 subtitles in terms of their reading behaviour (eye movements) and reading speed; and

⁵ Afrikaans is used as a control group for this experiment – because there are limited factors influencing Afrikaans L1 speakers' language learning and usage (for both Afrikaans and English), the data and findings for Afrikaans L1 speakers were collected and analysed first so it could serve as the baseline for comparison with other languages, in this case, Sesotho.

⁶ In order to do this with precision, further calculations will have to be made based on the reading speed of the general population – data will have to be collected on reading in all the different languages and language groups in South Africa. This does not fall within the scope of the current study.

⁷ *Interlingual* subtitles are subtitles that are produced in a language other than that of the original soundtrack, as opposed to *intra-lingual* subtitles where the subtitles are in the same language as the original soundtrack. For the purpose of the current study the focus is placed on the use of interlingual subtitling only.

(3) to consider the implications of the findings for the improvement of subtitling in South Africa by working towards the development of guidelines for the future production of L2 subtitles in South Africa.

It should be noted that this study focused on the use of interlingual subtitling in the entertainment industry and that the implications of the findings are also discussed within this context.

1.8 APPROACH

In order to achieve the objectives outlined above, the study comprised a literature review and an empirical study.

1.8.1 Literature review

The literature review focused on key texts and studies on the following concepts:

- Characteristics of eye movements;
- Eye-tracking research focused on reading and the reading of subtitles;
- Reading behaviour when reading subtitles;
- The benefits and drawbacks of subtitles; and
- Reading L1 and L2⁸ subtitles.

The aim of this section of the study was to gain insight into previous studies and methods used in studying the reading of subtitles and to derive from this the various factors that have to be taken into consideration for L2 subtitle viewers. Emphasis was placed on the reading behaviour of people viewing subtitled programming – the findings provide the basis for future guidelines for this specific context. The development of such guidelines is briefly discussed in the conclusion to the current study, along with recommendations for further research on the matter.

As is indicated in this section of the study, not much research has been conducted specifically on the differences between L1 and L2 reading of subtitles by means of eye tracking. Previous eye-

⁸ Although reading English as a second language is of particular importance here, the literature review will not be limited to discussing English only; reading in a second language is examined in general.

tracking studies have focused mainly on **language acquisition** (Danan, 2004; Caimi, 2006; Sokoli, 2006; Van Lommel *et al.*, 2006; Chai & Erlam, 2008), proving that **reading subtitles is an automatic action** (d'Ydewalle *et al.*, 1991; Van Lommel *et al.*, 2006; d'Ydewalle & De Bruycker, 2007), that **subtitles influence comprehension and recognition** (Koolstra *et al.*, 1997; Koolstra *et al.*, 1999), and that **reading foreign language subtitles is somehow different from reading L1 subtitles** (De Bruycker & d'Ydewalle, 2003; Van Lommel *et al.*, 2006; d'Ydewalle & De Bruycker, 2007). However, no distinction has been made between a foreign language and a second language, which are two distinctly different things. Consequently reading in L1 and L2 has not received particular attention. A gap in existing research was therefore found and matters requiring further research were brought to the fore.

1.8.2 Empirical research

Broadly, this study set out to examine the effectiveness of English second language (L2) subtitles by presenting native speakers of Afrikaans and Sesotho with subtitles displayed in (a) their native language (Afrikaans or Sesotho), and (b) in L2 English, while monitoring their eye movements with an SMI iViewX™ Hi-Speed eye tracker. Participants were shown a French animated short film with Afrikaans, Sesotho or English subtitles, or a combination of either Afrikaans or Sesotho and English subtitles. This was determined by the L1 of the participants and the groups they were randomly assigned to.

However, the subtitle viewing was not the only empirical component of the study. The empirical study was conducted in three phases: reading static text, viewing subtitles and completing a questionnaire. The findings drawn from the eye-tracking data for subtitle viewing were considered the primary findings of this study. Before conclusions or generalizations could be made about L1 and L2 subtitle reading, however, potentially confounding factors needed to be considered. This was done by analysing the secondary data – the data gathered from participants' reading of static text(s) and corresponding comprehension test(s), as well as participants' responses to a questionnaire on their reading behaviour, reading preferences, access to subtitled television programming and subtitle reading. This secondary data was analysed along with the primary data in order to find possible correlations and/or significant interaction(s) which might explain the findings for subtitle reading.

Chapter 1: Introduction, contextualization and problem statement

The **dependent variables** for the current study were identified as the reading effectiveness of subtitles in terms of absorption and vertical movement as measured by key eye-tracking parameters. The **independent variables** were as follows: (a) language (L1 or L2); (b) reading speed and comprehension; (c) demographic aspects (reading and audiovisual habits, socioeconomic and personal attributes); and (d) subtitle length (one-line or two-line, word count, character count).

All the gathered data was statistically analysed by means of Statistica – the methods that were used include ANOVAs, multiple regressions, t-tests, correlations and crosstabulations.

1.9 ETHICAL CONSIDERATIONS

Prior to the experiment, participants were informed about the use and basic functions of the eye tracker and were told what to expect of the experiment they were about to participate in (read a static text, view a short film and complete a questionnaire). Care was taken to not make any references to subtitling or subtitle reading in order to keep participants unbiased toward the nature and purpose of the study. Participants were also reminded that their participation was completely voluntary and that they were free to leave at any point, should they wish to do so. After completion of the experiment, participants were given a consent form to sign that gave the researcher permission to:

- (a) View and analyse their personal information as provided in the questionnaire;
- (b) Record their reading of plain text and of subtitles by means of a non-invasive eye tracker; and
- (c) Report, anonymously, the data gathered from the questionnaire as well as the eye-tracking data for plain text reading and subtitle reading in the current study as well as in any report or publication that follows from it.

This consent form was issued to participants after the experiment had been completed because it contained important information pertaining to the purpose of the study and would have influenced participants' natural reading behaviour. It should be noted, however, that the consent issues were discussed thoroughly prior to the experiment and that participants were informed that they were to sign a consent form after the experiment had been completed.

1.10 CHAPTER DIVISION AND OUTLINE

Chapter 2: Eye tracking as a method to study reading and subtitling

This chapter discusses the relevant literature on the use of eye-tracking technology to study different aspects of reading. Emphasis is placed on the findings of previous research as well as the methods and parameters employed in order to reach these findings. Chapter 2 also gives a thorough overview of the basic characteristics of eye movements in order to understand eye tracking and reading behaviour in general. Furthermore, attention is paid to aspects of reading and comprehension, reading in a second language, and research on the reading of subtitles, all as measured by eye tracking. Gaps in existing research are also identified in order to emphasise the need for further research.

Chapter 3: Methodology

Chapter 3 outlines the method(s) employed in the execution of the current study. It discusses the preparation, design and execution of the different phases of the experiment, the research instruments used, as well as the sampling procedure and methods of data collection and statistical analyses.

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

This chapter analyses the collected data for Afrikaans L1 speakers and interprets the findings of the statistical methods employed. The findings of both descriptive and inferential statistical analyses are presented along with an interpretation of results obtained from all three phases of the experiment, in other words the questionnaire and two different sets of eye-tracking data (the reading of static text and subtitle reading).

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

This chapter analyses the collected data for Sesotho L1 speakers and interprets the findings of the statistical methods employed. The findings of both descriptive and inferential statistical analyses are presented along with an interpretation of results obtained from all three phases of the experiment, in other words the questionnaire and two different sets of eye-tracking data (the reading of static text and subtitle reading). The findings for the Sesotho L1 speakers are also

Chapter 1: Introduction, contextualization and problem statement

compared to the findings for the Afrikaans L1 speakers in order to emphasise significant differences and/or similarities.

Chapter 6: Conclusions and recommendations

Chapter 6 provides a summary of the research findings, a discussion of the conclusions made and recommendations for future research. Comments are also made about possible shortcomings of the current study that need to be addressed in future experiments of this nature.

CHAPTER 2

Eye tracking as a method to study reading and subtitling

Numerous eye-tracking studies have been conducted on the reading of static text and some work has also been done on the reading of subtitles. This chapter aims to give an overview of existing research in the field of eye tracking and reading as well as to identify opportunities for future research and gaps in existing research that have to be addressed in the current study.

2.1 TERMINOLOGY

Before studying previous eye-tracking research on reading, it is important to identify and define some key concepts and terminology. This section cites definitions of reading and distinguishes between some of the most important characteristics of eye movements such as fixations, saccades, smooth pursuits, the gaze path and regions of view.

2.1.1 Reading

There are many different definitions and descriptions of reading and what reading entails. Sereno and Rayner (2003:489) simply define it as “the visual comprehension of language”. Wagner *et al.* (2006:1120) elaborate on the notion of comprehension by stating that comprehension is the aim of reading and that this requires that the reader unravels or ‘decodes’ the way in which the message is conveyed (Wagner *et al.*, 2006:1112). This implies that the reader reads through the links binding the text in order to find the message that is intended for the target audience (Wagner *et al.*, 2006:1120). According to Le Cordeur (2010:349) reading refers to the meaning a reader gets from a text and brings to a text in a process that is threefold – an interactive, affective and cognitive process between the reader, the text and the author. Perego (2008:39) is more detailed in her description:

Reading is a highly complex perceptual cognitive activity that consists of acquiring information from a written source. Reading, which by comparison with oral language comprehension is an ‘unnatural’, demanding process (Rayner and Polatsek, 1989), involves a number of inter-related processes as readers decode a written text by accessing, identifying and holistically combining letters into words, words into phrases and phrases into sentences, an essential process known as parsing.

Dehaene (2009:4) emphasises the complexity of reading by describing it as a human invention and stating that the human brain was not invented and developed for reading – reading is a ‘skill’ that is acquired and self-taught: “Nothing in our evolution could have prepared us to absorb language through vision.” As Assink *et al.* (1996:383) therefore rightly state, reading is much more than the mere processing of orthographical elements. Pretorius and Machet (2004:45) similarly argue that “[t]he ability to read refers to more than just being able to recognise letters and decode words; it includes the ability to construct meaning from the written word and familiarity with the various forms and functions of written texts.” Dehaene (2009:48) adds to this by stating the following:

Alberto Manguel was right: it is the reader who confers meaning to the written page – his “able eye” gives life to what would otherwise be a dead letter. Letter and word identification result from an active top-down decoding process whereby the brain adds information to the visual sign.

If this applies to normal reading (the reading of static text), it is even more complex for the reading of subtitles, in which case it is not only reading of text that occurs, but reading in the presence of other input channels – the visuals as well as the dialogue and complete soundtrack of the film or programme, with the added complication that the text is only visible in transient chunks, placing additional demands on memory and cognitive load (cf. Gibson 1998). These are the greatest concerns for the reading of subtitles and feature prominently in studies on the topic. These matters are discussed in more detail in the sections to come (cf. sections 2.3 and 2.4.3).

Le Cordeur (2010:349) distinguishes two aspects of reading – reading as a cognitive process which relates to a reader’s comprehension, and reading as a mechanical process which refers to the smoothness of a reader’s reading. For the purpose of the current study, reading is regarded as a combination of these two processes.

2.1.2 Fixations

Kollmorgen and Holmqvist (2007:2) state that “[...] eye traces corresponding to reading are nearly exclusively composed of fixations and saccades”. But what are fixations and saccades? According to Pollatsek and Rayner (2006:614), fixations can be defined as periods when the eyes are relatively still and during which “new visual information is encoded from the text” and

absorbed. Simply put, they are the eye ‘movements’ that coincide with a test subject staring at a particular point (SMI, 2009a:11). Perego (2008:35) adds to this by stating that:

During reading, our eyes do not move smoothly across the page. They “make a series of jumps [...] along the line. Between the jumps the eyes remain relatively still, for about a quarter of a second, in what is referred to as a *fixation*” (Rayner and Polatsek, 1989:6, emphasis in original).

Adding to this, Dehaene (2009:17) states that “[r]eading is nothing but the word-by-word mental restitution of a text through a series of snapshots,” with ‘snapshots’ referring to fixations and the intake of information that occurs during fixation.

Fixations are commonly regarded as the most relevant and most reported eye-tracking data, and although a fixation typically lasts anything from 35 ms up to several seconds (Holmqvist *et al.*, forthcoming:23), for skilled readers the average fixation is calculated at approximately 200-250 ms (Richardson *et al.*, 2007; Star & Rayner, 2001; Pollatsek & Rayner, 2006). As fixations vary in length, one can conclude that the intake of information will vary as well. However, as fixations seldom occur in isolation, it is safe to say that there is an overlap of information from one fixation to the next. This is according to Pollatsek and Rayner (2006:617) who found that “[r]eaders do not obtain a chunk of information on one fixation and then a different chunk of information on the next fixation.” Should these fixations be made concurrently within a specific sentence, paragraph or object, the number of fixations and the fixation durations are considered an indication of processing difficulty (Just & Carpenter, 1980; Praet *et al.*, 1990; McConkie & Yang, 2003; Morris & Williams, 2003; Liversedge *et al.*, 2004; d’Ydewalle & De Bruycker, 2007; Perego, 2008; SMI, 2009b).

In an overview of previous studies conducted over many years, McConkie and Yang (2003:413) summarise the reasons for fixations being longer and commonly followed by refixations as cases where the eyes are or were directed at less frequent words, words containing spelling errors, more ambiguous words, inappropriate words in terms of context, and words located in places that require more processing. This has a direct bearing on subtitling where the need for processing ease in order to minimise distraction from the other sign systems is foremost – in other words, the more time viewers fixate on words to recover the meaning, the less time is available to decode the visual signs.

2.1.3 Saccades

Saccades are the rapid movements made by the eye in between fixations. SMI (2009a:11) describes it as the eye movements made by the eye when jumping from point to point in the image viewed. Holmqvist *et al.* (forthcoming:23) are more detailed in stating that it is “the rapid motion of the eye from one fixation to another (from word to word in reading, for instance)”. For some studies, however, the distinction is made the other way around: saccades are detected as the primary eye movements while fixations are regarded as secondary. In their study on the eye movements of children and adults while reading television subtitles, d’Ydewalle and De Bruycker (2007) made use of a saccade detector and defined a saccade as a period when said detector “was active for two or more samples in sequence” and continued until a period of inactivity of at least five samples (d’Ydewalle & De Bruycker, 2007:198). A blink was next defined as a period of detector activity but with the pupil missing for at least three samples in sequence. Lastly, a fixation was defined as something that was neither a blink nor a saccade (*ibid.*). The distinction therefore depends on the needs and priorities of the experiment at hand. Regardless, saccades occur at enormous speeds, ranging from 30 to 80 ms (according to Holmqvist *et al.*, forthcoming:25), during which no information is acquired or processed. However, although no data is acquired or processed, saccades do not interrupt the processing that continues from a preceding to a subsequent fixation (Vonk & Cozijn, 2003:291). In fact, Vonk and Cozijn (2003:294) see saccades as an important part of processing while reading and therefore argue that “saccade durations are part of the time spent in language processing [...], therefore, their durations should be included in accumulated measures of reading time.” During reading the average saccade size is estimated at approximately 7-9 letter spaces for skilled readers (Richardson *et al.*, 2007; Star & Rayner, 2001; Pollatsek & Rayner, 2006).

2.1.4 Smooth pursuit

According to Holmqvist *et al.* (forthcoming:25), smooth pursuits are not to be confused with saccades – both involve movement of the eye from one point to the next, but a smooth pursuit is slower and follows a specific object (e.g. when our eyes follow a bird across the sky). In the pursuit movement, the eye follows an object in an attempt to fix that object on the retina (SMI, 2009a:11) in order to fully and clearly process the object. Saccades, on the other hand, occur at random without following a specific item. Smooth pursuit is also referred to as “pursuit tracking” and defined as “the foveation of a moving object” as the object being tracked is held in the fovea

and thus fixated (Crundall & Underwood, 1998). Therefore smooth pursuit eye movements are essentially nearer to fixations than saccades in that information is gathered (or held), whereas during saccades no visual information is acquired at all.

The important distinguishing factor between smooth pursuits and saccades is the visual environment in which they occur – smooth pursuits occur with dynamic scenes or texts where objects are in motion and where they eyes need to follow these objects; saccades are the jumps to and from objects, regardless of whether the objects are in motion. Smooth pursuit movements are therefore limited to dynamic scenes or texts and do not occur with static text reading. With subtitle reading the subtitles appear as static text within a dynamic scene⁹, with the additional complexity that the static text has a severe time constraint because it is not constantly visible. In this case, smooth pursuits do not have direct bearing on the reading of the subtitled text, but on the fact that there are dynamic elements on the screen that compete with the subtitles.

2.1.5 Gaze path

The gaze path of the eye is “the path the eye takes while studying a stimulus image” (SMI, 2009a:12). In other words, it is the order of fixations and saccades as they occur from the moment the image appears until the eye moves away again to focus on something else. With a static object or image, the person viewing it decides where to look and for how long before moving on to another part of the image. Each object viewed within the image would therefore reflect its own gaze path and order of saccades and fixations as it was looked at by the viewer. The same can be said of the image in total, as the order of saccades and fixations would indicate how the viewer viewed the image as a whole. With dynamic or moving stimuli such as films, however, the viewer is not in control of the time available for viewing and switches focus rapidly between objects and people as they appear and disappear on various parts of the screen. The gaze path here would typically be more erratic and scattered across the display area because the viewer realizes that there is not a lot of time and there is a lot to see and take in.

⁹ An exception here would be the use of dynamic subtitle display such as scrolling subtitles or push-up scrolling subtitles where words are displayed one at a time and where a whole line is pushed upwards in order for the next line to appear. However, for the purpose of the current study, the focus will be on the use of non-dynamic subtitles that appear in chunks of one or two lines at a time with all the text in the respective subtitles appearing simultaneously and for a set amount of time based on the amount of words or characters per subtitle.

2.1.6 Regions of view

When reading lines of text, the text falls on the retina of the eye and, depending on the reader's point of fixation, can be divided into three different regions: foveal, parafoveal and peripheral (Star & Rayner, 2001; Pollatsek & Rayner, 2006).

Richardson *et al.* (2007:323) state that “[t]he human eye covers a visual field of approximately 200°, but receives detailed information from only 2°.” This area is known as the **foveal region** of the eye and is an area of high visual acuity. According to Pollatsek and Rayner (2006:615) this region “corresponds to the central 2° of visual angle around the fixation point (for text at a normal reading distance, 1° of visual angle is equivalent to roughly 3-4 letters)”. They also state that this area is specialized for processing detail and that any text falling outside this region would be difficult to identify as “visual acuity drops markedly” (*ibid.*). The foveal region extends into the **parafoveal region** (approximately 5° of visual angle to each side of a fixation) where some letter information can still be obtained (*ibid.*). In this regard, Underwood *et al.* (2000:248) refer to what is known as the perceptual span, “the region from which effective information is acquired during a fixation”:

Previous research has shown that the perceptual span is asymmetric (Pollatsek, Bolozky, Well and Rayner, 1981), with its extent ranging from 3 to 4 letters to the left of fixation (Underwood and McConkie, 1985), to a maximum of approximately 15 letters to the right (McConkie and Rayner, 1975).¹⁰

In terms of reading in different languages, Dehaene (2009:17) states that the reader's visual exploration strategy differs depending on the language and the script itself – whereas in the West the visual span of the reader is greater toward the right (the direction of reading), this asymmetry is reversed for languages that read from right to left. Furthermore, “[i]n other writing systems such as Chinese, where character density is greater, saccades are shorter and visual span is reduced accordingly” (*ibid.*). Regarding perceptual ability in general, Dehaene (2009:14-15) states the following:

¹⁰ The asymmetry and measure of perceptual span referred to here applies specifically to alphabetic languages that are read from left to right.

[...] our perceptual abilities depend exclusively on the number of letters in words, not on the space these words occupy on the retina. Indeed, our saccades when we read vary in absolute size, but are constant when measured in numbers of letters. When the brain prepares to move our eyes, it adapts the distance to be covered to the size of the characters, in order to ensure that our gaze always advances by about seven to nine letters. This value, which is amazingly small, thus corresponds approximately to the information we can process in the course of a single fixation.

Lastly, the **peripheral region** extends from the parafoveal region to the very edge of visual perception – readers are usually aware of the text in this region, but the information acquired here does not really aid reading (Pollatsek & Rayner; 2006:615). Star and Rayner (2001:159) furthermore argue that, because of the acuity in the foveal region “we move our eyes to place the fovea on that part of the text we want to see clearly.”

2.1.7 Other measures of importance

From the abovementioned key characteristics, various other measures of eye movements are derived. These include glances, dwell time, regressive movements and progressive movements, which are all measured in terms of ‘areas of interest’. An area of interest (AOI) is a specific object which is identified as something that requires visual attention and could be anything from a word or a sentence to a specific part of a visual image (such as the logo in a marketing campaign) or a subtitle in a subtitled film or programme. One therefore selects and defines the AOIs relevant to or required by the experiment at hand. As with the gaze path, AOIs also differ for static and dynamic stimuli. In a static image, for instance, the object one wants the viewer to focus on as AOI is visible for the entire duration of the image’s visibility (i.e. for as long as the image is displayed) and eye movement calculations can be made accordingly (see discussion of specific measures below). With a dynamic stimulus, such an object might appear and disappear at random. However, marking this object as an AOI means that it is possible to get eye movement data and measurements on how the object was viewed throughout the presentation.¹¹

Dwell time starts the moment the AOI is fixated and ends the moment the last fixation on the AOI ends, in other words it is the sum of all fixations and saccades that hit the AOI (SMI,

¹¹ Marking an AOI is one of the many actions one is able to perform with the SMI BeGaze™ 2.5 software. The software allows you to mark any area or object as an AOI with a circle, rectangle or polygon depending on the size and shape of the object you want to mark. During data analysis, recordings are then grouped and presented according to each AOI.

2009b:142). Dwell time, therefore, literally reflects how long someone “dwelled” in an AOI, in other words, how much time was spent processing it. **Glances** are also measured in terms of an AOI, but unlike dwell time, which only calculates movements within the AOI, glances include the saccades from outside the AOI to the AOI (*ibid.*) and its duration is calculated as the sum of the dwell time and the duration of the saccade entering the AOI (SMI, 2009b:153).

Regressive and **progressive eye movements** are also movements that are measured in terms of AOIs. **Regressive movements** relate to return movements of the eye to a previously fixated AOI whereby the AOI is re-fixated. This is usually preceded by regressive saccades made back to the AOI after it has been fixated for the first time (SMI, 2009b:173). According to SMI (*ibid.*), regressions within words (i.e. inside individual words) are thought to reflect lexical activation processing in trying to understand the word, while regressions between a number of words reflect sentence integration processes. These measures are particularly useful when studying reading, perhaps even more so in cases of second-language learning or language acquisition as it reflects the different issues that the second-language reader may come to face, namely vocabulary access and grammar processing. **Progressive movements**, in turn, refer to movements made by the eye to an AOI that is yet to be fixated, for example a word further along in the line of a text being read. A progressive fixation is also usually preceded by a progressive saccade (*ibid.*). Data on regressive and progressive eye movements are mostly calculated for static texts where each word is automatically marked as an AOI. To date, these measurements are not calculable for embedded texts such as subtitles which form part of the filmic image viewed.¹²

2.2 GOOD VS. BAD READING

Pollatsek *et al.* (2003:361-362) acknowledges that, in previous years, studying eye movements was not considered useful in studies on reading, but that this has changed in recent years:

However, it is now clear that the moment-to-moment pattern of eye movements is responsive to aspects of the meaning of the text, such as the frequency of a word in the language, and therefore cognitive acts, such as recognizing a word, do influence the behaviour of the eyes (at least some of the time) in a moment-to-moment fashion.

¹² This applies to the SMI BeGaze™ 2.5 software in particular, but might differ for other eye-tracking systems.

From what has previously been stated, it is evident that the frequency and length of fixations are an indication of the processing demands of what is being read or observed. Pollatsek and Rayner (2006:621) agree by stating that “one of the most robust findings in studies of eye movements and reading is that the ease or difficulty associated with understanding a word during reading clearly affects how long readers fixate on that word”. They elaborate on this even further by explaining that readers make longer fixations and shorter saccades when text is more difficult to read and comprehend, and that this also coincides with regressions (backward movements) into the text (Pollatsek & Rayner, 2006:615), thus relating it directly to processing activities.

2.2.1 Variables that influence eye movements during reading

Star and Rayner (2001:157) point out that, in the case of fluent reading, “saccades move the eyes so that a word can be focused on the retina so that it can be more effectively processed [...] However, both saccade length and fixation duration fluctuate considerably from word to word”. Apart from the reasons stated by McConkie and Yang for longer fixations and refixations (cf. section 2.1.2), Pollatsek and Rayner (2006:621-628) add the following list of variables that influence word recognition and eye movements: Word difficulty, contextual constraint, lexical ambiguity (number of meanings), phonological coding, semantic relationships between words, morphological effects and plausibility effects. These variables are discussed in detail in the paragraphs to follow by referring to key studies, most notably Pollatsek and Rayner (2006).

According to Pollatsek and Rayner (2006:621) **word difficulty** is most commonly measured in terms of word frequency. Thus, the less frequent a word is encountered by someone, the longer it will take to process that word. This frequency measure, however, coincides with other variables such as word familiarity and age-of-acquisition, both of which have been proven to influence how long it takes to process a word (Pollatsek & Rayner, 2006:622). Morris and Williams (2003:236) agree by emphasising the effect of lexical familiarity and frequency on fixation duration – in words of equal length, low frequency words lead to longer fixation duration than high frequency words. Liversedge *et al.* (2004:1023) similarly found that word frequency affects how long a word is fixated, while Nuthmann and Engbert (2009:323) argue that “fixation durations decrease with increased word frequency”. Age-of-acquisition, however, is not regarded without speculation and has been considered a mere effect of frequency and a determining factor of familiarity, and the concreteness of words (concrete words are acquired first, abstract words later on) is one of a few possible variables that need further exploration (Pollatsek & Rayner,

2006:622). In terms of subtitle reading one would therefore have to take care not to insert words that are unnecessarily difficult or complex, especially if the readers are reading in a language other than their L1 – if the readers focus and fixate too long on a word trying to understand what it means, they might lose valuable time for reading the rest of the text and viewing the images, which might ultimately affect their understanding of the material as a whole.

In studies on reading, **contextual constraint** has been used as a measure to determine the effect of context on the recognition of words, whether the context surrounding certain words aids or complicates the recognition of words that still have to be read further on in the text. In addition to this, Morris and Williams (2003:240) found that “word meanings are more readily acquired from context than through definitional instruction” as the summation of the findings of previous studies on the matter. Pollatsek and Rayner (2006:623) agree and furthermore state that numerous studies have found that less time is spent on reading words that are predictable given their preceding context than words that are not. Nuthmann and Engbert (2009:323) agree that fixation durations decrease with increased word predictability. Morris and Williams (2003:240) similarly found that “words preceded by semantically related context are processed faster than words that are preceded by unrelated context”. This was proven even in the absence of word predictability and lack of strong semantic counterparts in the preceding context (Morris & Williams, 2003:241). However, the measure of predictability is also linked to other variables such as “transitional probability” according to which certain words are conventionally followed by certain other words, making them easier to read and thus coinciding with shorter fixations (Pollatsek & Rayner, 2006:623). Context has also been said to aid new word learning because of the reasons mentioned above. Morris and Williams (2003:243) found that, when reading, people make connections between the informative context and unfamiliar words in the sense that said context prompts readers to make regressions to a preceding unfamiliar word. More regressions were found when the preceding word was unfamiliar than for familiar word(s) (Morris & Williams, 2003:244). The implications of this for L2 subtitle reading would be the same as for using words that are too difficult for the reader to understand immediately – valuable time will be lost in trying to figure out the meaning of the word, which will affect the readers’ viewing and ultimately their understanding of the material.

Lexical ambiguity (the number of different meanings a word could have) strongly relates to context and, according to Pollatsek and Rayner (2006:623), has a direct influence on the search for the correct meaning of that word in context and consequently causes a longer fixation time.

Chapter 2: Eye tracking as a method to study reading and subtitling

This was also found by Morris and Williams (2003:241). If the text following this word were to suggest that a different meaning was intended, the reading would be disrupted, causing longer fixations and regressions (Pollatsek & Rayner, 2006:624). Apart from context it has also been reported that ambiguity in terms of syntactic category, in other words, words that could function as both verbs and nouns “resulted in delayed effects” in deciding which meaning to use, and that “with verbs with two meanings, the resolution of verb meaning ambiguity is delayed” (*ibid.*). All these instances illustrate that lexical ambiguity has an effect on the time it takes to process words in text (*ibid.*).

The same can be said of **phonological coding**. Pollatsek and Rayner (2006:624), in reporting on the findings of previous studies, summarise this variable as follows:

Words that are phonologically ambiguous (like *tear* and *wind*) have substantially longer gaze durations than unambiguous control words (Carpenter & Daneman, 1981) and words with two different spellings, but with the same pronunciation (and two different meanings, such as *beech-beach* and *shoot-chute*), also have longer fixation times than unambiguous control words.

Choosing the correct words are important for the readability of subtitles – if the words chosen are difficult, ambiguous and/or unknown within the given context, viewers will be distracted from the visuals on-screen and will spend most of their time trying to figure out the meaning of the word(s). The implication of this is that, by the time they finish reading the subtitle, the next subtitle will already appear and they will have lost information from the surrounding audiovisual elements, causing even more confusion and flustered reading of the subtitles. It is therefore important for L2 subtitle readers that care is taken to ensure that the choice of words and level of language used do not put additional, unnecessary strain on the reading of the subtitles.

Semantic relationships between words also influence the processing of words during reading. It has been found that, if two words that are related in meaning are situated near each other in a text, the second word would receive a shorter fixation in total than if it were to be replaced by a random, non-related word (Pollatsek & Rayner, 2006:625). On a more technical level, if there is a disagreement between a noun (e.g. singular) and its determiner (e.g. plural) or any discrepancies of this nature, “there is an increase in the duration of the first fixation on the critical word” (*ibid.*), indicating that the eye spots the error and lingers on it before moving on. Much can be said, also, for the relation between syntactical errors and complexities in a text and

the eye movements of the person reading it. Although it has been found that “syntactical violations” do not affect comprehension (Perego, 2008:55), it does affect reading behaviour and would be evident from eye-tracking data (cf. section 2.2.2). If this holds true for normal reading situations (reading text on paper), one can only imagine the implications for subtitle reading where the text is only visible for brief and varying amounts of time – readers might waste time wondering about the syntax and either not finish reading a particular subtitle before the next subtitle appears, or neglect to view the surrounding visuals on the screen. These detailed effects, however, have yet to be proven by means of eye-tracking analysis.

Some of the most significant eye-tracking research on **morphological effects** to date has been conducted on the complex nature of Finnish words (Pollatsek & Rayner, 2006:625). It was found that the frequency of the constituent parts of compound words influenced the gaze duration on the compound word itself (*ibid.*). When applied to English, a smaller constituent frequency effect was observed in those English words that were of the same length as the shorter Finnish words, an effect that was not only observed in English compound words, but also in English prefixed words (*ibid.*). Another effect that was observed in both English and Finnish was “morphological decomposition for both opaque and transparent compound words,” where semantic transparency was taken to mean that the meanings of the constituent parts related to the meaning of the word (*ibid.*). Like syntactic complexity, lack of semantic transparency in subtitled text can cause readers to only focus on the text and not have enough time to view the rest of the visuals.

Studies on **plausibility effects** refer to the effects of implausible or anomalous elements in sentences on eye movements during sentence parsing. Pollatsek and Rayner (2006:626) report the following:

Rayner *et al* concluded that the default situation in reading is for lexical processes to drive the eyes through the text in reading, but when something does not compute at a higher level (as with the anomalous sentences), then higher-order processes could intervene and cause the eyes to fixate longer (though the influence of such higher-order effects manifest themselves in relatively late processing) time measures on a target word (i.e., in the gaze duration and go-past measure, but not in the first fixation or single-fixation duration measure). What is still not clear, however, is how to objectively define the difference between the implausible and anomalous sentence contexts.

Sereno and Rayner (2003:490) summarize the abovementioned variables and their influence on eye movements by stating that “words that are short in length, regular in their spelling–sound

Chapter 2: Eye tracking as a method to study reading and subtitling

pattern, frequent in their occurrence, or semantically or syntactically predictable from a previous context are fixated for less time than those that are not”. These variables are all relevant in studying the reading of second language texts as one would be able to directly observe the processing difficulty of each segment as it is read.

It must be emphasised, however, that most of the studies in which the abovementioned findings were made, were conducted on static texts. Not many eye-tracking studies conducted on the reading of subtitles specifically have gone into such detail regarding the subtitled text that is read. One possible reason for this could be that some eye-tracking software cannot distinguish between the video material and the subtitles – because the subtitles are embedded in the film or visual material, it is considered “part of the image” and is not discernable as text.¹³ Therefore basic insight can be gained into aspects like distribution of attention and fixation count and total time spent in the subtitled area, but a detailed analysis and critical “dissection” of the text read is not immediately possible with existing software. The calculations could possibly be done manually, but a proper methodology needs to be developed in order to do so. Regardless, the actual *reading* of subtitled text needs to be addressed in detail in future research, especially if one wants to be able to compare different readers’ interaction with the text itself as part of the comparison of L1 and L2 subtitle reading.

2.2.2 Eye movements, textual complexity and comprehension

When examining previous studies on reading and comprehension, certain characteristics come to the fore. In their study on the relation between eye fixations and comprehension, Just and Carpenter (1980:329) argue that a person can read as fast as his or her internal comprehension processes allows, and that therefore, through studying someone’s eye movements as they read, it would be possible to gain information about the comprehension process itself – for them this involves “determining the relations among words, the relations among clauses, and the relations among whole units of text” (Just & Carpenter, 1980:341).

One of their most significant findings on reading and processing is the so-called “eye-mind assumption” (Just & Carpenter, 1980:331) which posits that “there is no appreciable lag between

¹³ This applies to the SMI BeGaze™ 2.5 software in particular, but might differ for other eye-tracking systems.

Chapter 2: Eye tracking as a method to study reading and subtitling

what is being fixated and what is being processed,” relating, of course, to the issue of more complex words or sentences requiring more processing and thus more time for reading, resulting in longer fixations (cf. section 2.2.1). McConkie and Yang (2003:414) add to this by stating that the cognitive processes that take place determine where and when the eyes move, bringing the visual information and the language process together. Morris and Williams (2003:246) affirm this by saying that “completion of lexical access is thought to be the trigger to move the eyes”. The study conducted by McConkie and Yang (2003) focuses on the effect of cognition on eye movements and is largely centred on saccade movements and triggers. According to them there are three ways in which cognition can influence the onset times of saccades: “[...] processing difficulties can inhibit and delay saccades; [...] parameters can be adjusted to text or task conditions; [and] given enough time, cognition can control saccades more directly.” (McConkie & Yang, 2003:413). Only the first reason is relevant to the current study – should the onset times of saccades be affected, so too would the fixation durations because the onset times produce the fixation duration (*ibid.*). In other words, the current fixation will last longer if the onset of the upcoming saccade is delayed. However, McConkie and Yang (2003) also found that, instead of relating the delay of saccades produced by text processing difficulties to the requirements of the cognitive system to interpret the problem, the delay itself was simply the result of the fact that a problem occurred during reading and that there was a problem during text processing (McConkie & Yang, 2003:417):

The fact that the more severe problems result in increasingly longer fixation durations is not the result of regulating the saccade delay according to the processing requirements, but to the fact that the earlier and more severe the processing difficulty, the larger the proportion of saccades that are cancelled and thus delayed by the inhibition.

Put differently, this is considered the real reason for the increase in fixation durations when a problem is encountered while reading, and not that more time is needed for processing as was stated by earlier studies. However, on some level both points of view still relate to the same finding: processing difficulties lead to longer fixation durations. Just and Carpenter (1980:350) found that readers interpret words while fixating them, and fixation continues until the word(s) have been processed as far as possible. In this case it could be that the subsequent saccade was delayed, or simply that the word was difficult and more time was needed for processing, but in both instances the outcome would be a longer fixation than if the word(s) were easier.

Chapter 2: Eye tracking as a method to study reading and subtitling

Another notion opposed by McConkie and Yang (2003) is that the eyes regress to parts of the text that require further processing. They argue that there is not much evidence that supports this notion, which in turn supports their argument that most regressive saccades are therefore “not generated by the purposive control of eye movements” (McConkie & Yang, 2003:423). They see regressions more as the result of a disturbance (a processing difficulty) encountered while reading, which in turn disrupts the normal reading pattern and forward-moving saccades (*ibid.*). Richardson *et al.* (2007:330) elaborate on this by attributing regressive saccades to “difficulties in processing an individual word, or [...] the meaning or structure of a sentence,” in which case the confusing part can be refixated. However, one could of course still decide to reread segments of a text should one wish to do so. As Just and Carpenter (1980:337) state, there are times when one needs to review or reread parts of a text “to re-encode it or process it to deeper levels,” but whether you intentionally decide to do so or whether this action is automatic depends on the extent of the confusion or processing difficulty that was encountered. McConkie and Yang’s overall conclusion on cognition and reading is that, although cognitive activities occur and might influence eye movements during reading, this eye behaviour is “usually produced on a non-cognitive basis” (McConkie & Yang, 2003:425). In other words, the eye behaviour is not planned or controlled through cognition or cognitive processes, but rather occur as a result thereof. In terms of subtitle reading this means that jumping back and forth between the subtitled area and the rest of the visuals above it is not necessarily planned, but rather necessitated by the need for understanding what has been read and relating that to the images on-screen (and vice versa) to complete the process of understanding.

Sereno and Rayner (2003:490), in their study on the measurement of word recognition during reading, found that reading involves more than the mere identification of individual words. They also found that “[b]ecause eye movements during skilled reading reflect moment-to-moment cognitive processes, the average fixation duration of 250 ms constrains the amount of time for lexical processing.” There is therefore not much time to process what needs to be processed. Although lexical processing is set in motion during the first 60 ms of the fixation, processing needs to be at a certain level within 100-200 ms in order to keep in line with the programming of the next eye movement (*ibid.*). However, the lexical difficulty will determine the fixation duration, so if more time is needed for processing before the next eye movement, this will result in longer fixation duration.

But just how much is processed during a single fixation? Just and Carpenter (1980:330) came to the conclusion that “[w]hen readers are given a text that is appropriate for their age level, they average 1.2 words per fixation. [...] The number of words per fixation is even lower if the text is especially difficult or if the reader is poorly educated.” Fewer words per fixation imply that more fixations would have to be made in order to read and process all the words. One could therefore measure and compare how readers perceive a complex text by looking at their average words per fixation or the number of fixations on words or within certain areas. However, in some cases individual words are fixated by themselves, without including other surrounding words. Richardson *et al.* (2007:330) state that the chances of this happening depend on whether the word is a content word or a function word, and also on the length of the word. According to them, the chances of a content word being fixated individually is 85%, whereas the chances of a function word is 35%; shorter words (2-3 letters) are often skipped while longer words (8 letters or more) are almost always fixated (*ibid.*; see also Star & Rayner, 2001). Texts that are complex might consist of longer or more difficult words than simple texts, which would result in more fixations. Richardson *et al.* (2007:330) confirm this by stating that “[e]ye movements also vary as a function of the syntactic and conceptual difficulty of the text.”

One example of syntactical complexity is found in Traxler *et al.*'s (2002) extensive study on the processing of subject and object relative clauses. They came to the conclusion that readers had more difficulty processing sentences containing object-relative clauses than sentences containing subject-relative clauses (Traxler *et al.*, 2002:69). They explain this by stating that “[w]hen the sentence contains a subject-relative clause, the initial syntactic analysis is correct and processing proceeds smoothly. When the sentence contains an object-relative clause, the initial syntactic analysis is flawed and syntactic reanalysis is triggered.” Difficulty was reduced when the sentential subject was inanimate and the subject of the relative clause was animate (Traxler *et al.*, 2002:83) and “[...] when the sentential subject was a poor agent and the critical nouns' roles were clearly indicated by the verb in the relative-clause.” (Traxler *et al.*, 2002:85).

When comparing the reading of less skilled and skilled readers, the differences are obvious. Star and Rayner (2001:158) found that, typically, “Less skilled readers (beginner, poor, and dyslexic readers) typically have longer fixations, shorter saccades, and make more fixations (including regressions) than skilled readers.” Therefore it follows logically that eye movements reflect reading problems.

2.3 NORMAL VS. SUBTITLE READING

Reading can be construed as the coordinated execution of a number of processing stages such as word encoding, lexical access, assigning semantic roles, and relating the information in a given sentence to previous sentences and previous knowledge.

(Just & Carpenter, 1980:332)

There is a considerable difference in the reading of normal, static (printed) text and the reading of television or film subtitles. The most noticeable difference lies within that which is read, the text. Static text is the printed material we read daily, like newspapers, magazines, journals, books, etc. Subtitles, on the other hand, are multimodal in nature and in the case of interlingual¹⁴ subtitles, co-appear along with three other input channels to form the complex polysemiotic composition which is a film or a television programme. These other input channels are the verbal auditory channel (dialogue, background voices and lyrics), the non-verbal auditory channel (natural sound, sound effects, music and paralinguistic information such as crying, sobbing, ironic tone etc.), and the non-verbal visual channel (composition of image, camera positions, movement and editing, costumes, actors/characters, scene, etc.) (Gambier, 2006b:260; see also Sokoli, 2006:3). Subtitles fall in the fourth group, the verbal visual channel, which portrays the verbal channel in writing. Gottlieb (1992:162) adds to the description of subtitles by referring to it as “a 1) written, 2) additive, 3) immediate, 4) synchronous and 5) polymedial¹⁵ translation”.

While the written component is obviously present in both, and although static text may also contain images, it is the simultaneous presentation of moving (dynamic) visual images, soundtrack and written subtitles that complicate the reading of subtitles. A further complication is that there is no one, single way of reading. As Just and Carpenter (1980:350) rightly state, “[r]eading varies as a function of who is reading, what they are reading, and why they are reading it.” De Linde and Kay (1999:17) consider subtitles to be textual discourse that substitutes oral dialogue, and when this occurs, the overall nature of the film narrative is changed. Accordingly, “verbal and visual information can no longer be processed simultaneously; instead,

¹⁴ As was mentioned in Chapter 1, the focus of current study is primarily on the use of interlingual as opposed to intralingual subtitling. Intralingual subtitling is not discussed in detail, although relevant aspects are referred to in this section of the study. Subtitling for the Deaf and hard-of-hearing as a form of intralingual subtitling, however, is not discussed – only references to subtitling where audiences have access to both the visual and audio channels are included in order to discuss the influence of all the competing channels on attentional demand.

¹⁵ According to Gottlieb (1992:162), polymedial here refers to the fact that “at least two channels are used to convey the total message of the original”.

they have to be processed in succession” (*ibid.*). This implies that the viewer’s attention has to be “divided between processing the image and reading the subtitles” (*ibid.*).

2.3.1 Attention allocation in reading

One common interest in eye-tracking studies conducted on reading thus far has been to examine eye movements when reading in the presence of two information sources – image and text. According to d’Ydewalle and De Bruycker (2007:197-198) numerous previous studies have found that, in static text reading, reading the text was always prioritized over looking at the image. In other words, participants’ eyes always moved to the text first, reading it, and only then moving to the image. d’Ydewalle *et al.* (1991:650) also confirmed this finding by stating that participants will always prefer one of the two modalities available, but also that they may, in some cases, prefer both.

Studying attention allocation in subtitling, however, differs from studying a static text with pictures because in the case of television or film there is, amongst other things, a considerable information overlap which often coincides with some information redundancy between input channels (d’Ydewalle *et al.*, 1991:651). In other words, some information may be present in more than one channel (audio, video, subtitles). Nevertheless, it has been proven that the shift between reading the subtitles and looking at the rest of the visuals on-screen occur “effortlessly and almost automatically” (d’Ydewalle & De Bruycker, 2007:196). d’Ydewalle and De Bruycker measured these shifts between the visuals on-screen and the subtitled area by calculating the “number of saccades from a fixation in the visual image to a fixation in the subtitle area” (2007:199). It was found that participants made more vertical shifts between the subtitled area and the visuals on the screen above it while reading two-line subtitles ($M = 0.54$) than when reading one-line subtitles ($M = 0.19$) (d’Ydewalle & De Bruycker, 2007:201).¹⁶

¹⁶ This finding was explained in accordance with the six-second rule for subtitle presentation (cf. section 2.3.3): “Given the 6-second rule for presenting the subtitles, with two text lines there is ample time available to jump back to the visual image after a careful first reading of the subtitle” (d’Ydewalle & De Bruycker, 2007:202). De Bruycker and d’Ydewalle (2003:679) similarly found more image-to-subtitle shifts for two-line (0.73) than one-line subtitles (0.25). d’Ydewalle *et al.* (1991:662-663) also found more vertical shifts for two-line subtitles based on presentation time – because participants anticipated less visible time for shorter texts such as one-line subtitles (or short two-line subtitles) they shifted their gaze to the subtitle very quickly, looked at it very briefly, and went back to the visuals. The other explanation offered was that “[participants] simply did not look as often at a one-line subtitle as they did a two-line subtitle” (d’Ydewalle *et al.*, 1991:663). The difference between the reading of one-line and two-line subtitles and its relevance for subtitling research is discussed in section 2.3.2 of the current study.

Chapter 2: Eye tracking as a method to study reading and subtitling

In terms of the multimodal availability of information, Praet *et al.* (1990) tested the effect of the overlap and redundancy by comparing the reading of subtitles¹⁷ with the reading of the same subtitles presented as simple sentences without images and sound. The result was as expected – the mean percentage of time spent in the sentences was larger with the simple reading (63.50%) than with reading the subtitles (30.67%) because in the normal reading situation there was no divided attention or reason to focus on anything but the text itself (Praet *et al.*, 1990:211). Furthermore, subtitles are more fleeting – they are not permanently displayed, therefore there is less time available for reading, meaning that sometimes less time will be spent reading. This not only applies to subtitles but to any form of text that has a time limit, and of course having to view images simultaneously does not ease the task as the shifts between text and images take up a lot of time in itself. In this regard, when considering these shifts in attention, there is a matter of agreement in how text and subtitles are viewed – Perego (2008:39) states that the repetitive shift between text and image when watching a subtitled programme is the same as for text-picture processing of printed material.¹⁸

In terms of attention allocation and specific eye movements, Schmidt-Weigand (2009:92) makes the following significant statement:

[...] fixating a discrete area (words, sentences, objects, etc.) is commonly taken as a correlate of attentional and cognitive processes allocated to the inspected area (eye-mind assumption). That is, at the beginning of each new fixation visual attention is assumed to be allocated to the stimulus at the center of fixation. When the information within this area is sufficiently processed attention may be reallocated to a new stimulus in order to program the next saccade while the eye remains fixated.

From this the question arises as to what determines where to look first. Steinberg (2004:4) claims that when processing perceptual information, people turn their attention toward that which is most relevant to them and that therefore “relevance is the guiding principle: perceptual input is processed in such a way as to yield the most interesting information at the lowest possible effort – the most relevant phenomena are preferred.” In a study on the influence of visual and temporal dynamics on split attention, Schmidt-Weigand (2009) found that in various instances of reading (reading advertisements, studying mechanical diagrams, watching subtitled television, reading

¹⁷ It is not clear whether this experiment was conducted with interlingual or intralingual subtitles as no reference is made to the language of either the subtitles or the soundtrack.

¹⁸ Within the context of the current study the shift between the subtitled text and the image is also referred to as ‘vertical movement’.

newspaper), people tend to favour text over pictures, and also that there is a tendency to attend to the written text first (Schmidt-Weigand, 2009:92). d'Ydewalle *et al.* (1991:660) similarly found that, when given a choice between text and speech elements, participants chose to read the subtitles, even though they were intralingual (i.e. in the same language as the dialogue). Should the presentation rate of the material then be increased, it follows logically that something will be missed or “not sufficiently processed” (*ibid.*) and as the text is attended to first and given more attention, it is usually the processing of visual material that lags behind. Of course, for viewers with poor reading skills, a faster presentation pace would lead to more processing difficulty and probably poorer comprehension (*ibid.*). Chai and Erlam (2008:36) also make note of processing difficulties and argue that “[v]iewing captioned video may lead learners to prioritise reading over listening and prevent them from making full use of auditory and other visual clues.”¹⁹

Although most comments regarding the allocation of attention during subtitle reading are concerned with reading text versus watching the rest of the visual matter presented, one should not forget about the soundtrack and other channels involved. Boguki (2004:83) reminds us that subtitles do not stand alone but are part of a bigger construct:

Subtitles cannot exist independently, in the same fashion as a film script that is unintelligible without the corresponding image and soundtrack. Thus, what the target text contains is a result of the application of multifaceted constraints and relevant cultural filters. Ideally, when presented to the audience together with the visual, verbal and sonic stimuli of the original (subtitling is additive, the TT does not replace the ST but supplements it), the effect it produces is maximal comprehension and appreciation at minimal processing effort.

However, the processing effort involved in reading subtitles cannot always be described as minimal. Of all the input channels involved, the subtitled text and the reading thereof have proven to be the most demanding in terms of processing. However, this does not mean that other elements like the soundtrack are not processed (Danan, 2004:72) – Danan states that in a previous study by d'Ydewalle and Gielen (1992), it was found that attention was divided between the text and the audio according to the needs of the person viewing it, “with more time usually devoted to subtitles for the processing of complex information” (*ibid.*). Schmidt-Weigand (2009:101) elaborates on this difference between text (reading) and viewing images by

¹⁹ In this study, Chai and Erlam (2008) made use of intralingual subtitling to determine its influence on second language learning. Participants were all Chinese learners of English who watched a film segment with dubbed English audio and with or without English subtitles to measure the difference.

Chapter 2: Eye tracking as a method to study reading and subtitling

stating that “[r]eading requires word-by-word fixations, lexical access, and syntactic as well as semantic processing while the information depicted by visualizations may be gathered at a glance.” (cf. section 2.3.1). Nonetheless, in a subtitled film or programme these visualizations have to be processed, as do the subtitles and as do the soundtrack, forming a complex system of comprehension.

Fehd and Seiffert (2008) did extensive research on the tracking of multiple moving objects. In the review of previous studies they make note of different theories regarding the position of gaze while tracking multiple objects. One of the theories is that viewers might make saccades between objects, “exposing them all to brief periods of high visual resolution” (Fehd & Seiffert, 2008:202). Here they specifically focussed on a tracking task that simulated air traffic control in which participants had to look out for object collisions. It was found that “participants made more saccades between targets of a potential collision than to other targets that were not in danger. This evidence suggests that making eye movements to targets during tracking helps participants keep track of them” (*ibid.*). When relating this finding to the reading of subtitles, it would make sense that viewers would make regular movements to and from the subtitled area in an attempt to ‘keep track’ of the information contained in both the subtitled text and the rest of the visuals. Another theory is that participants might focus on a central position while tracking (*ibid.*). In a much earlier study, Tosi *et al.* (1997:50) indeed found that, when viewing film, participants favoured a centre position on the screen²⁰ in order to take in as much information as possible – participants only moved their eyes to the peripheral areas of the screen when objects appeared there. The exception was text – whenever textual elements such as subtitles or signs appeared, participants would immediately move their eyes to that location. With reading subtitles, choosing a central position between the subtitled area and the visuals above it as a ‘base position’ might lead to smaller jumps between the two areas and perhaps provide easier access to both channels of information. Although watching subtitles is not a form of tracking as such as a specific object is not followed around the screen, these theories still provide some insight on aspects to consider when determining attention allocation when viewing subtitles and also holds certain implications for subtitle placement on the screen.

²⁰ Tosi *et al.* (1997) are not the only ones to have found this. The notion of a ‘centre bias’ is a common finding among eye-tracking studies conducted on television and film viewing (see also Brasel & Gips, 2008).

2.3.2 Eye movements during subtitle reading

De Bruycker and d'Ydewalle (2003:676) argue that looking at subtitles is an automatic process, but that looking at a subtitle and therefore paying attention to it do not necessarily imply that word-by-word reading occurs. They refute this notion, however, and from their findings it is evident that subtitles are indeed “fluently processed, and that true reading is apparent” (De Bruycker & d'Ydewalle 2003:680), a notion also emphasised by Van Lommel *et al.* (2006). In addition, it was found that more regular reading occurs with two-line than with one-line subtitles²¹ (cf. Praet *et al.*, 1990; d'Ydewalle *et al.*, 1991; De Bruycker & d'Ydewalle, 2003; d'Ydewalle & De Bruycker, 2007).

The difference in reading one-line and two-line subtitles is a matter that has received considerable attention. Praet *et al.* (1990) found that, when presenting subtitled text as normal text (i.e. without images or sound), it is more difficult to read one-line sentences than two-line sentences, which is the opposite of the effect usually observed for subtitle reading (Praet *et al.*, 1990:212). This was proven by a number of findings, such as that the number of fixations on one-line sentences was more than half the number of fixations on two-line subtitles and that mean fixation durations on one-line sentences were typically longer (367 ms) than those on two-line sentences (340 ms) (Praet *et al.*, 1990:209). These findings were emphasised by stating that “[i]f the number of fixations on a line of text reflects the difficulty of processing that text, this finding indicates that reading the one-line sentences involved more processing demands than reading the two-line sentences.” (*ibid.*). From this they assumed that reading two-line sentences was facilitated in some way (Praet *et al.*, 1990:212), also the opposite of what is usually observed for subtitle reading. The main finding was still that, for subtitle reading, one-line subtitles were processed faster than two-line subtitles.

In a following study, d'Ydewalle *et al.* (1991:650) found that for intralingual subtitle reading “[t]he proportion of time spent reading subtitles is consistently larger with two-line subtitles than with one-line subtitles”. d'Ydewalle and De Bruycker (2007) came to the same conclusion (but this time for interlingual subtitle reading) in that they found that participants in their study spent more time in two-line subtitles (M = 45%) than one-line subtitles (M = 37%) (d'Ydewalle & De

²¹ This was found for both interlingual and intralingual subtitles.

Chapter 2: Eye tracking as a method to study reading and subtitling

Bruycker, 2007:200) and that fixations in one line subtitles ($M = 212$ ms) were shorter than fixations in two-line subtitles ($M = 228$ ms) (*ibid.*).²² Consequently, they found a more regular reading pattern with two-line subtitles (d'Ydewalle & De Bruycker, 2007:201). Furthermore, De Bruycker and d'Ydewalle (2003), who also studied interlingual subtitles, found that more reading occurs with two-line subtitles because "longer sentences are less redundant with the pictorial information" (De Bruycker & d'Ydewalle, 2003:671). It might seem contradictory that a shorter sentence (less information) contains more redundancy, but the explanation is simple: A one-line subtitle is considered more redundant because it does not necessarily provide much more information than can be deduced from the sound (auditory message) and the visuals (images) on the screen, meaning that it is less important for the understanding of the story and therefore requires less time for reading than would two lines of text containing more information (d'Ydewalle *et al.*, 1991:206). d'Ydewalle *et al.* (1991:657) note that the presentation time allocated to one and two-line subtitles respectively might influence how they are read, stating that participants may have taken more time to read two-line subtitles not necessarily because they needed more time, but because more time was available. This might also account for the more regular reading pattern found with two-line subtitles, but still needs to be investigated to a greater extent.

Regarding attentional demands, d'Ydewalle and De Bruycker (2007:201) found that, although it had been said that shifting attention between the visual image and reading in the subtitle region occurred automatically, more vertical shifts occurred with two-line subtitles than with one-line subtitles. d'Ydewalle and De Bruycker (2007:202) explained this by referring to the six-second rule for subtitle presentation – with two-line subtitles, more time is available for reading and therefore, after a first reading of the subtitle, there is still time available to go back to the visual image. Nevertheless, all researchers are in agreement that more and longer fixations indicate more processing demands. Furthermore, most studies agree that it takes longer to read a two-line subtitle than a one-line subtitle and that this is most likely due to a lesser degree of redundancy in two-line subtitles. This should be taken into account when creating subtitles for second language readers in order to aid second language reading and also learning.

²² Although not explicitly discussed in the findings, it is noted that more fixations made in a subtitle resulted in more time spent in the subtitle (d'Ydewalle & De Bruycker, 2007:202).

Chapter 2: Eye tracking as a method to study reading and subtitling

Apart from the matter of reading one-line versus two-line subtitles, there are other, telling differences in eye movements when performing different tasks such as reading and picture or film viewing. When reading, eye movements are more or less predictable because the reader will typically move through the text systematically, and apart from regressions, return sweeps and other eye movements in-between, the basic eye movement behaviour would be to move through the text and words line-by-line until the whole text has been read. With pictures and/or film viewing, this is not the case as people view them differently, depending on what draws their attention and where they decide to look. McConkie and Yang (2003:423) found that in these different conditions, fixation duration differs: “It should be noted that fixations in tasks in which appropriate eye movement behaviour is less predictable, such as during picture viewing, tend to be longer on average than fixations in reading.” Consequently, fixations lasting up to 500 ms are not impossible for picture viewing, but rarely occur during reading (*ibid.*). These findings correlate with Rayner *et al.*'s later findings (2009:10):

[E]ye movement parameters in reading do not correlate well with those in scene perception, face perception, and visual search. Although the neural mechanisms controlling the oculomotor system are invariant across tasks, the cognitive processes associated with the tasks manifest themselves in different ways. Specifically, in the present case, *the encoding of the scene properties takes longer than the encoding of words in reading.* (My emphasis)

Although in their findings Rayner *et al.* (2009) did not measure fixations lasting up to 500 ms as McConkie and Yang, they did find that participants needed at least 150 ms per fixation to process a scene as opposed to the 50 or 60 ms needed to process a word (Rayner *et al.*, 2009:6). Subtitles are usually created in adherence to certain rules or guidelines that promote readability, legibility and professionalism. Although each subtitling company or entity works predominantly according to their own guidelines in aid of conformity, the guides share some universal rules that have proven to be successful over the years (see Baker *et al.*, 1984; Karamitroglou, 1998; BBC, 1998; Ivarsson & Carrol, 1998; ITC, 1999; IMS, 2000, 2005; Díaz Cintas & Remael, 2007). Of these rules, the most prominent would be that subtitles have to be synchronous with the onset and ending of speech (i.e. the subtitles have to appear and disappear in accordance with the spoken dialogue); that subtitles should not continue over shot and scene changes (shot changes could still be excusable, but never scene changes); that a maximum of two lines are allowed, placed at the bottom of the screen; that a maximum of 37 characters (including punctuation and

Chapter 2: Eye tracking as a method to study reading and subtitling

spaces between words) be used per line²³; and that, due to spatial restrictions, the text might have to be condensed in some instances without leaving out critical information. Although all these rules may influence reading and perception of the subtitles, the first two mentioned (synchronicity and shot/scene changes) may have more definite effects. De Linde and Kay (1999:116) came to the following conclusion regarding the latter issue:

Subtitles that are allowed to over-run shot changes can cause considerable perceptual confusion. Eye movement research (Baker 1982) has suggested that shot changes which occur while a subtitle is being shown cause viewers to return to the beginning of a partially read subtitle and start re-reading.

Similarly, if a subtitle is brought on too early before the start of speech or left on too long after it has finished, or if the subtitles overlap with the next subtitle's dialogue, people might also be confused and reread segments. In some cases, if two subsequent subtitles look the same, people might not realize that a new subtitle has appeared and start reading it too late. These effects would be clearly visible through eye-tracking studies, but as of yet no one has focused on these aspects of subtitle reading specifically.

2.3.3 The six-second rule for subtitle presentation

Another difference between normal reading and the reading of subtitles is the fact that, when reading subtitles, the text is not constantly available. Guillory (1998:95) states that “[g]ood readers in any language know how to scan for selected words. In general, good readers have shorter fixations and longer “jumps” between words and always move forward through the text”. Opposed to this is the notion that poor readers make regressive movements on a more frequent basis (*ibid.*). However, when viewing subtitled television or films, one does not have the option of regressing, which results in the poorer readers missing segments of the story and missing information that might be vital for their understanding thereof. In other words, with normal reading one can read and reread a part or parts of a text for better understanding because you have the full text in front of you. One can therefore also cross-reference facts or points

²³ Although this convention has been established and applied as a rule over the years, it is now rapidly changing, both in the guidelines and in the professional practice. It is being replaced, to an increasing extent, by a newer approach in which the safety area on the screen is used as a limit, meaning that lines may often exceed 38 characters per line as long as it remains within the limits of the screen and no text is at risk of disappearing or “falling off” the sides of the screen. This is already being applied in some subtitling countries, most notably the United Kingdom.

Chapter 2: Eye tracking as a method to study reading and subtitling

mentioned later in the text with facts stated earlier, scanning for the information that you need. With subtitles this is not the case. The text appears on-screen for a fleeting moment, disappears, and is replaced by a new piece of text. One is not given the opportunity to go back and read the text again at a later stage. Because the text has to reflect what the people on the screen are saying, there needs to be a close synchronization between the onset and offset of speech and the appearance and disappearance of subtitles (according to Díaz Cintas and Remael (2007:88) this is the “golden rule” of spotting subtitles). Therefore there are major time constraints on the presentation time of subtitles, which in turn affects people’s reading thereof.

Guiding the presentation rate of subtitles is the so-called “six-second rule” (cf. Praet, *et al.*, 1990; d’Ydewalle *et al.*, 1991; Koolstra *et al.*, 1999; De Bruycker and d’Ydewalle, 2003; Van Lommel *et al.*, 2006; d’Ydewalle & De Bruycker, 2007; Díaz Cintas & Remael, 2007). According to this rule, a two-line subtitle with a maximum of 37 characters per line should be given a presentation time of 6 seconds because it is estimated that this is easily readable by “the average viewer” (Díaz Cintas & Remael, 2007:96). The presentation times of shorter subtitles are then calculated proportionally (d’Ydewalle *et al.*, 1991:654; Koolstra *et al.*, 1999:407; d’Ydewalle & De Bruycker, 2007:196). Some sources state that the six-second rule applies to a maximum of 32 characters per line, but this is most likely because of the difference or preference of companies to use more or fewer characters per line.

According to Díaz Cintas and Remael (2007:96) the calculation of the six-second rule implies “a rather slow reading speed” of 140 to 150 words per minute. Whether this reading speed is ‘slow’ is debatable and depends on the country or region where it is applied – for less literate audiences this might be perfect, while for more literate audiences it might seem extremely slow-paced and cause considerable annoyance. One should remember, however, that when watching a film or television, people are actually watching the screen and should not be spending the entire time reading subtitles. Even though presenting subtitles at normal reading speed is a possibility, it does not leave much time for people to watch the images on-screen too. Romero-Fresco (forthcoming, 2011) has started research on what he calls ‘viewing speed’ – “the speed at which we watch a scene with subtitles and images” (Romero-Fresco, forthcoming, 2011:23) – because the reading speeds usually suggested for subtitles are based on the reading speeds for static text, which has much fewer constraints and thus are not adequate for the complex nature of subtitled film or programme viewing.

Koolstra *et al.* (1999:408) mention that, although generally applied in all countries using subtitles, to date little research had been conducted on how optimal this measure actually is for viewing and reading subtitles. However, in their study on whether the lengthening of subtitle presentation time would improve children's reading of subtitles, they found that children did not necessarily benefit from prolonged subtitle presentation time. They found no satisfactory results to indicate that the problems children encounter when reading subtitles are solved when the six-second rule is extended to eight or ten seconds (Koolstra *et al.*, 1999:420). They did, however, find that younger children struggled with the reading of subtitles displayed according to the six-second rule because the subtitles were too fast: "Probably the younger and poorer readers were discouraged by the short presentation time to such an extent that they put little effort in trying to follow the subtitles" (Koolstra *et al.*, 1999:418). They also found that subtitles displayed according to the ten-second rule lead to elementary schoolchildren spending more time reading them (*ibid*). However, along with the rest of the hypotheses tested in the study, these findings did not prove to be significant: Obviously if more time is given, more time will be spent reading; also, the longer display of subtitles did not lead to an improvement in subtitle recognition (Koolstra *et al.*, 1999:419). Furthermore, such a dramatic extension in presentation time would in turn lead to further complications such as rereading (in the case of more skilled readers) or that subtitled text would have to be shortened or edited down severely to contain more information in order to prevent subtitles from overlapping (Koolstra *et al.*, 1999:420).

Therefore, although the six-second rule is widely accepted, it has yet to be tested and (re)confirmed, especially in South Africa, through the use of eye-tracking technology to examine whether it is still accurate and efficient, providing sufficient or excessive reading time.²⁴

2.4 READING SUBTITLES IN DIFFERENT LANGUAGES

Many eye-tracking studies have been conducted on the reading of subtitles in different languages, most significantly on the difference in the reading of what is referred to as "foreign" and "native" subtitles, where the foreign language is a language that is not known to the viewer and the native language is the viewer's mother-tongue language. From this one might ask: "Does

²⁴ A test of this nature is highly recommended in diverse societies such as South Africa where one reading speed cannot be proposed for the entire country due to extreme varying literacy levels. However, this test does not fall within the scope of the current study; the six-second rule will instead be used as a guideline for the subtitles presented in the experiment.

one actually read that which is written in an unknown language?” The answer to this is a definite “Yes”. It has been proven that subtitles are processed automatically, regardless of other factors such as knowledge of the foreign language in the soundtrack, the availability of soundtrack or familiarity with subtitling (d’Ydewalle *et al.*, 1991; Van Lommel *et al.*, 2006; d’Ydewalle & De Bruycker, 2007). Furthermore, De Bruycker and d’Ydewalle (2003:672) argue that “[i]f subtitles are effectively processed (and read), subtitling may be considered a teaching tool for children who are in the process of learning to read, or for people who are experiencing reading difficulties”. Although this might aid learning, Van Lommel *et al.* (2006:244) emphasise that, in order for language acquisition to occur fully, both the foreign and native languages have to be processed to a certain degree. This can be said of L1, L2 and foreign language subtitles. In all instances, the presence of the subtitles along with the soundtrack and the visual information on the screen should facilitate learning to some extent through connections and inferences made between the different input channels (De Bruycker and d’Ydewalle, 2003:672). However, the question remains as to what difference there actually is in how these languages are read.

2.4.1 Reading foreign language subtitles

A number of studies have focused on the reading of standard versus reversed methods of subtitling (Pavakanun, 1992; De Bruycker & d’Ydewalle, 2003; Van Lommel *et al.*, 2006; d’Ydewalle & De Bruycker, 2007), where ‘standard’ subtitles refer to the normal subtitling condition where the soundtrack is in the foreign language and the subtitles in the native language; and where ‘reversed’ subtitles refer to the opposite condition, with the soundtrack in the native language and the subtitles in the foreign language. These experiments have clearly illustrated that reading subtitles are automatic and that subtitles are still read to a certain extent even though they are written in a language that is unknown to the reader.

In their study on the reading of native and foreign languages by children and adults, De Bruycker and d’Ydewalle (2003) report the findings of Pavakanun (1992) on attention allocation. The aim was to determine the effect of similarity between foreign and native languages on the reading of subtitles in a standard and reversed condition. Regardless of the similarity between languages, Pavakanun found that in both subtitling conditions (standard and reversed), participants read the subtitles (De Bruycker & d’Ydewalle, 2003:676). The smallest percentage of time spent in the subtitles was in a foreign language in the reversed condition and was measured at 40.29%, which is still a significant amount of time considering that it was not necessary to read them at all. In

Chapter 2: Eye tracking as a method to study reading and subtitling

the reversed subtitling condition it was found that more time was spent in two-line than one-line subtitles (*ibid.*), which coincides with previous studies on the processing difficulty of one-line and two-line subtitles. It was also found that the two-line subtitles evoked longer latency times (*ibid.*), which means that the viewers took longer to shift their attention to these subtitles.

In their own experiment, De Bruycker and d'Ydewalle (2003) set out to look more specifically at reading and not only attention allocation. They found that more word-by-word reading occurs in standard than reversed subtitling, and that participants spent more time in the subtitle area in the standard condition (41%) than in the reversed condition (26%). Their findings are summarised as follows:

In short, participants with standard subtitling shift attention to the subtitles faster, stay longer in the subtitle area, and return to it more frequently after having focused on it a first time. Of course, this was to be expected, since participants need the native language subtitles to follow the story line.

(De Bruycker & d'Ydewalle, 2003:678).

Despite spending less time in the subtitle area in the reversed condition, a total of 60% of the words were fixated, indicating that reading did occur to a certain extent (*ibid.*). The findings of De Bruycker and d'Ydewalle (2003) coincide almost exactly with the later findings of d'Ydewalle and De Bruycker (2007) in this regard.

When considering the actual benefits of subtitling, Koolstra *et al.* (1997) made some interesting discoveries regarding its effect on reading. In a panel study conducted over three years, they found that reading foreign language subtitles improved children's decoding skills (Koolstra *et al.*, 1997:148). However, it was proven that the subtitles did not aid or improve the children's skills in reading comprehension. Two reasons were offered for this, firstly that "reading subtitles does not provide practice in comprehending coherent text" (*ibid.*), and secondly that "subtitles offer only short transcriptions of the dialogues in television programs [...] subtitles have to be read at a forced and fast pace, leaving little opportunity to reflect on the text" (Koolstra *et al.*, 1997:132). In addition it was found that, in the long run, simply watching television (not necessarily with subtitles) had a negative effect on children's reading comprehension because (a) the more the children watched television, the less they read books and other reading materials (the "displacement hypothesis"), and (b) the more the children watched television, the more

negative their attitude became towards reading books and other reading materials (the “reading-depreciation hypothesis”) (Koolstra *et al.*, 1997:147-148).

2.4.2 Reading L1 and L2 subtitles

To date, most research on L1 and L2 subtitles has focused on language transfer, comprehension in terms of memory load and the use of second language subtitles in an educational environment. Not much has been reported on the actual reading of the subtitles in terms of the differences in how they are read, and even less on eye movements while reading.

In the previous chapter it was noted that reading L2 subtitles is a complicated matter. Many of the questions surrounding L2 reading and learning relates to whether the reader will be able to cope with listening, reading and viewing at the same time (Chai & Erlam, 2008:27). This remains a valid question, even though previous studies have found that “[p]resenting material bimodally (i.e. combining visual and verbal modes) may enlarge working memory capacity, leading to improved learning outcomes.” (Chai & Erlam, 2008:26). Of course, whether someone would struggle to keep up with the reading depends on the reader’s level of understanding of the L2 in question. The reader’s working knowledge of the L2 will also have an effect on how effective reading the subtitles are for further language learning. In the experiment conducted by Chai and Erlam (2008), three out of ten participants that viewed a second-language film (English) with first-language subtitles (Chinese) said they could not pay attention to all three the information sources and therefore prioritised the one they felt was the most helpful: the subtitles (Chai & Erlam, 2008:34). The main reason for this was stated as “reading is easier than listening” (*ibid.*). Yet two other participants said they only read the subtitles when they did not understand the dialogue (*ibid.*). Regarding further matters of attention allocation, Chai and Erlam’s (2008) findings can be summarised as follows:

The result was that, for some participants, captions [subtitles] competed with sound. They reported times when they were unable to read and listen at the same time. Captions, also, at times competed with pictures. Whilst most participants reported being able to switch flexibly from captions to visual images and back again, this was not always the case. There were cases when participants reported that they had not had enough time to look at pictures after they had finished reading the captions and trying to work out what they meant.

(Chai & Erlam, 2008:36)

Chapter 2: Eye tracking as a method to study reading and subtitling

In an educational environment this means that teaching methods should be varied in order to stimulate all learning channels (visual, verbal and auditory). In a normal viewing, non-educational environment the implications are different. One certainly needs to ensure that subtitles are optimal and efficient for second-language readers, but one also needs to ensure that they do not detract from the overall viewing experience. The implication that not all people process subtitles similarly should also be considered in this regard.

Other matters that directly influence the reading of subtitles are those concerning readability and legibility. These terms are similar in meaning, and according to Perego (2008:35) “are often confused and used interchangeably although the former [*readability*] refers to the ease of reading as determined by the organization of information units and by typographic design as a whole, whereas the latter [*legibility*] refers to the ease with which a person manages to identify characters or letters.” Readability issues include the technical aspects of subtitle presentation on a macro-level (e.g. font, size, colour, and area of display) as well as micro-level aspects such as sentence structure, word choice and semantically coherent line breaks. Of the macro-level features, Caimi (2006:88-89) recommends the following:

In order to be fully effective, subtitles must be highly legible because they should distract the viewers as little as possible from the moving pictures. It is acknowledged that readers familiar with subtitles absorb the information conveyed by written dialogues subconsciously, while non-accustomed viewers are busy watching and listening to the audiovisual product, and their reading speed is likely to be reduced because only part of their time is spent on reading. Consequently, the layout of the subtitle is crucial.

One aspect of layout is line and/or subtitle breaks. Some of the most established subtitling guidelines in practice (Baker *et al.*, 1984; Karamitroglou, 1998; BBC, 1998; Ivarsson & Carrol, 1998; ITC, 1999; IMS, 2000, 2005; Díaz Cintas & Remael, 2007) agree on the fact that line breaks should occur at logical, semantically coherent places in a sentence to facilitate the reading of the subtitles. The same can be said for subtitle breaks when one sentence continues over more than one subtitle – if the sentence is not split at a logically coherent place, the sentence would be difficult to read and the logic difficult to follow. This holds true for any subtitles, but may even be more important in the case of L2 subtitles due to the slower processing speed, particularly if the reader is not that well-acquainted with or literate in the language.

Chapter 2: Eye tracking as a method to study reading and subtitling

According to Perego (2008:44) issues regarding readability need to be addressed foremost in aid of the different groups that make use of subtitles, one of which is second language learners “for whom a coherent and comprehensible organization of the information contributes to transforming complex input into intake, thus enhancing the mechanisms of language learning”. One should also keep in mind that Deaf and hard-of-hearing audiences might also have to read in their second language and for them “the readability of a text in their second language is a prerequisite for accessing any sort of audiovisual product” (*ibid.*). However, as subtitling for the Deaf and hard-of-hearing does not fall within the scope of the current study, further matters pertaining to this specialized form of subtitling will not be addressed here.

Grammatical and syntactical issues should also be handled with care. Perego (2008:49) sums this up by stating that “[s]pecial attention should therefore be paid not only to structurally ambiguous or semantically complex phrases, but also to compositional strings of words, in order to avoid triggering a ‘doubletake’ and the need for a reanalysis.” These ‘doubletakes’ would be clearly visible if one were to examine the reader’s eye movements. As is the case with the variables mentioned earlier which influence eye movement behaviour (cf. section 2.2.1), any complexities experienced by the reader would be detectable by means of eye tracking (cf. section 2.2.2).

2.4.3 The benefits and drawbacks of reading subtitles

Subtitling is considered a valuable learning tool. Countless studies have been conducted on the use of subtitles within the educational environment. Caimi (2006:89) states that: “The importance of the educational dimension is evident when we consider the function that subtitled multimedia products have in our societies.” This explains why most studies on L2 subtitling thus far have been conducted within the context of language learning or teaching and aimed at language acquisition (cf. Koolstra & Beentjes, 1999; Koolstra *et al.*, 2002).

Nowadays watching TV or videos may rank among people’s most common experiences that influence the way they think, speak and behave. Multimedia products represent a generalized type of entertainment which bears the unintentional character of naturalness. If intralingual subtitles are added to all films and TV programmes, they maintain their entertainment character with a touch of intentional purposefulness that turns them into effective devices aimed at enhancing second/foreign language learning opportunities. They may be considered natural language acquisition experiences that can favour language learners of any age.

(Caimi, 2006:92)

Chapter 2: Eye tracking as a method to study reading and subtitling

In much the same way this can also be said of interlingual subtitling. Watching television with interlingual subtitles on a regular basis provides a natural learning situation – readers may improve their knowledge of the foreign language in the soundtrack if the subtitles are in their mother-tongue or if the soundtrack is in their mother-tongue and the subtitles are in a foreign language. However, as was stated before, in order to benefit in terms of language learning, there has to be some level of existing knowledge of the foreign language in question. However, apart from language learning, viewers can also benefit simply in the form of having access to foreign-language programming and perhaps developing an awareness of or interest in an unknown language. As Guillory (1998:104) states: “Reading subtitles is an easily performed act, and subtitles make us feel comfortable because we can readily access meaning while watching foreign language films.”

The most common criticism of subtitled television and film or any subtitled material in general is that it distracts from the viewing of the visuals on-screen and detracts from the viewing pleasure that was intended. Chai and Erlam (2008:27) point out that “[t]here is also the potential that reading captions may detract attention from other visual and/or auditory information, meaning that viewers may miss out on valuable clues.” Consequently many people dislike watching subtitled programmes. This does not hold true for all viewers, though, as many people greatly enjoy watching subtitled art films and others simply enjoy having access to translations of foreign language filmic dialogue they would otherwise not have understood. In these cases the viewers may have become accustomed to reading subtitles to such an extent that they don’t even notice them anymore. A number of studies conducted in India on the use of same language subtitling (SLS) for song-based television programmes (Kothari *et al.*, 2002; Kothari *et al.*, 2004; Kothari, 2008) have shown that people greatly enjoy seeing the words to their favourite song. In this case, however, the subtitles are not shown for entertainment purposes alone – it is part of an initiative to aid literacy skill development in India. The benefit, however, is that due to the nature of the programmes the people are unaware of the fact that they are actually practising their reading:

The power of SLS lies in the fact that [it is] covertly educational and ‘adds’ to the entertainment value. While enhancing the entertainment value of popular song programmes, SLS simultaneously makes reading practice an incidental, automatic and subconscious process. The popularity of SLS has been established through the overwhelming positive viewer feedback from viewers in Gujarat.

(Kothari *et al.*, 2002:64)

Chapter 2: Eye tracking as a method to study reading and subtitling

It therefore depends greatly on the viewer whether the subtitles are seen as an aid or an irritation. As is evident from the studies conducted by Kothari *et al.* (2002), Kothari *et al.* (2004) and Kothari (2008), this matter is often considered in terms of the benefit towards literacy. Ayonghe (2009) investigated the use of subtitling as an aid in academic literacy programmes at the University of Beau in Cameroon. In her overview of previous studies on the benefits of subtitling within the educational environment, Ayonghe gave a very detailed and comprehensive overview of their findings. She stated that “[t]hese studies all support the assumption of this study that watching subtitled popular television programmes does not only serve as entertainment but will eventually lead to better reading ability and increased comprehension of the linguistic content of the programme, thereby promoting the use of new words and expressions within context.” (Ayonghe, 2009:61). From her own empirical findings Ayonghe also proved that continual exposure to subtitle viewing did indeed improve students’ reading skills.

The benefits of subtitling have also been discussed extensively in terms of its value for increasing comprehension. In her study on the effects of full-text subtitles as opposed to reduced (keyword) captions and no subtitles on learner comprehension²⁵, Guillory (1998) found that both full text subtitles and reduced (keyword) subtitles had positive effects on the learners’ understanding of authentic video²⁶ (Guillory, 1998:95). However, comprehension had been complicated by the rate of speech and the level of vocabulary used (Guillory, 1998:102), and consequently comprehension was slightly lower than expected – for normal subtitles the amount of reading required was too much (too much information to take in); whereas the keywords may not have provided enough information (*ibid.*). Guillory also found that second language subtitles motivated learners to read, but because there was so much to read, this had a negative effect on their processing of the linguistic message (Guillory, 1998:104). Within the educational environment that her study is set, her suggestion to use keywords as an alternative method because of its lesser textual density is a viable option, but, unfortunately this is not applicable to subtitles of television or film subtitles for public viewing. Regardless of this, her insights on issues of comprehension do provide valuable pointers for the creation of subtitles: avoid overly complex sentences and bombarding the viewer with too much information.

²⁵ Guillory (1998) made use of French second-language subtitles for French second-language video material to study the effect of both on adult college learners of French, in other words intralingual subtitles for second-language learning.

²⁶ “Authentic video presents real life situations; truly authentic video is not scripted, nor is the rate of speech or lexical appropriateness adjusted for learners” (Guillory, 1998:90).

Guillory also discusses the theoretical construct of multichannel processing and its model which explains the reasons for breakdown in communication (Guillory, 1998:95-96). According to this model, when viewing subtitled material there are four modes of input: video, textual rendering of speech (subtitles), sounds (not dialogue) and linguistic information (phonology, syntax, semantics, and discourse – hesitations, returns, repeats, tone of voice, etc.) (Guillory, 1998:96). As these modes are all displayed at the same time, they are “fed simultaneously (in multiple channels) to an attention moderator in the brain which filters the information for the next processing component” (*ibid.*). Figure 2.1 illustrates this processing effect clearly.

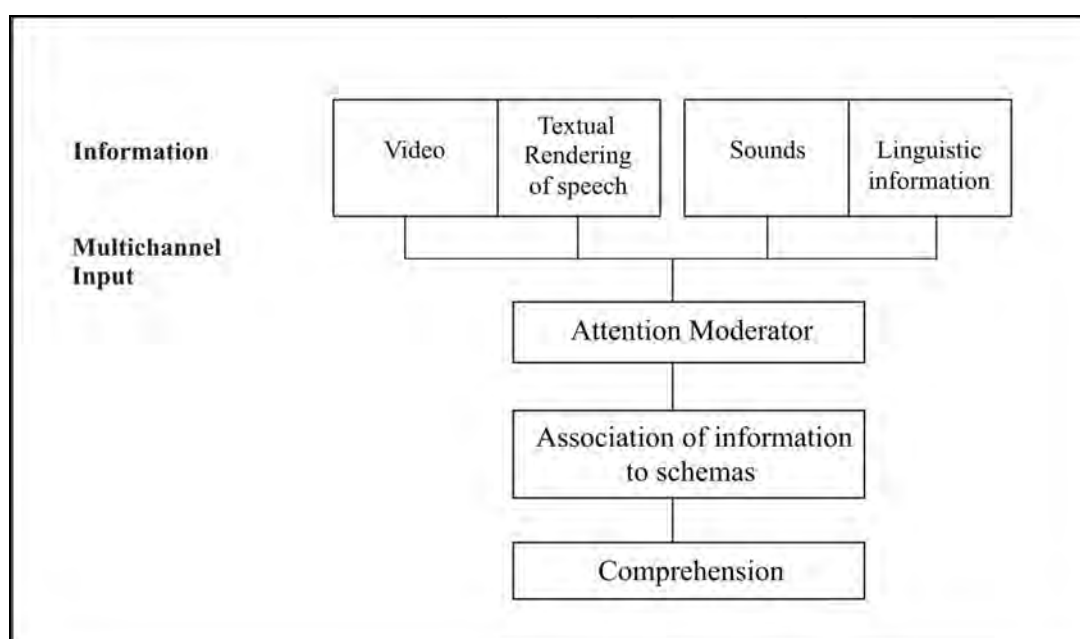


Figure 2.1 “The Input Processing of Multichannel Feeds Including Grimes’ (1991) Attention Moderator Construct”, taken from Guillory (1998:96).

Comprehension takes place due to the restructuring of information which happens when the filtered information is linked with the viewer’s schema (Guillory, 1998:96-97). Guillory also explains how comprehension is broken down:

According to this model, an interruption in the multichannel input causes normally simultaneous processing to become sequential (Grimes, 1991). When the attention moderator must disengage from multiple channels and monitor one channel at a time, part of the information coming through the other channels is lost. The result is a breakdown of the comprehension process. Such interruptions occur when learners must attend, for example, more to the textual channel than the linguistic message. If the action of the video requires more attention than the textual channel, the benefit of captions is lost.

(Guillory, 1998:97)

Chapter 2: Eye tracking as a method to study reading and subtitling

Overall it is clear that there are pros and cons to subtitling, which all depend on the reason for using subtitles and the intended goal thereof. In general, the main aim of using subtitles is to grant people access to materials they would otherwise not have had. Accessibility is therefore a key aspect and central to a lot of discussions surrounding the use of subtitles:

In my opinion, there is a strong relationship between usability as a measure of the effectiveness, efficiency and satisfaction with which specified users can achieve specified goals in a particular environment (as a web site or a software or an AV product) and accessibility as a means to make web content, and film content available to all users, whatever tool they are using (voice browser, mobile phone, etc.) or whatever constraints they may be operating under (noisy surrounding, under-illuminated room, etc.) The goal of usability is a *better experience for the user*; the goal of accessibility is *equality of access* – both have implications for design and the use of different semiotic systems as color, font size, punctuation, intonation, voice pitch, and so on (My emphasis).

(Gambier, 2006a:4-5)

One should also remember another aim of subtitling, which is to “aid the audience in comprehending and appreciating the filmic message” (Bogucki, 2004:82). Subtitles therefore need to be designed and presented in a manner that is optimally useable and that grant optimal and sufficient access to the people who view the programme in order to make it not only comprehensible but also enjoyable. These matters relate strongly to the focus of the current study and the ultimate aim of presenting people with adequate subtitles.

2.5 LIMITATIONS OF EYE TRACKING AND PREVIOUS STUDIES

As with any experiment, there are certain limitations to eye-tracking data. d’Ydewalle and De Bruycker (2007:203) argue that eye movements and predetermined oculomotor strategies may be confused in text-like materials; that eye movements “do not always reflect ongoing cognitive activities to process and understand information”. Vitu *et al.* (1995:356) came to the conclusion that whether people are looking for a specific character or letter in a text or simply scanning strings of meaningless text, their eye movements are basically identical to those observed during reading in terms of saccade size and fixation duration, as well as other aspects like refixation probability and refixation position (*ibid.*; see also d’Ydewalle & De Bruycker, 2007:204). Pollatsek and Rayner (2006:616) agree by stating that:

Chapter 2: Eye tracking as a method to study reading and subtitling

While eye-movement data are very informative with respect to lexical processing and understanding reading, they are not perfect reflections of the mental activities associated with comprehension. There is a purely motoric component of eye movements, and low-level visual and oculomotor factors can also influence fixation time and saccade length.

However, as a basic means of differentiation, Holsanova (2007:5) distinguishes between two “behaviours” – reading behaviour, which consists of well-defined movements across the text being read; and scanning behaviour, which consists of large saccades made in almost every direction as the reader is contemplating the text and evaluating whether certain pieces require further processing (i.e. in-depth reading). Other research has also shown that eye movements differ for different tasks like reading, scanning and other forms of visual search (d’Ydewalle & De Bruycker, 2007:204), contradicting the possibility of confusing eye movements of reading and non-reading and also indicating that reading did in fact occur. The experiments with the reading of native versus reversed subtitling are perfect examples of this (cf. section 2.4.1) – if the readers simply scanned the foreign language subtitles without reading them, they would not have performed above chance level on post-viewing foreign language word and sentence recognition tests (d’Ydewalle & De Bruycker, 2007:204). As d’Ydewalle and De Bruycker (*ibid.*) admit though, the link between the eye movements in these cases and foreign language acquisition still needs to be analysed in depth.

Studies on the difference between reading, scanning and other activities include those of Vitu *et al.* (1995), Rayner and Fischer (1996) and Nuthmann and Engbert (2009). Nuthmann and Engbert (2009:322) argue that “[d]uring reading, word processing is the main task, but it is subject to the restrictions arising from the oculomotor system that moves the eyes.” This highlights the common issue of distinguishing between cognitive and oculomotor reasons behind eye movements because, in fact, both low-level oculomotor mechanisms (e.g. word length) and moment-to-moment cognitive processes have been found to affect eye movements during reading (Nuthmann & Engbert, 2009:333). Both Vitu *et al.* (1995) and Nuthmann and Engbert (2009) refer to the so-called ‘mindless reading paradigm’ in instances where participants read ‘mindless’ strings of letters instead of ordinary text (e.g. “Zzzz zzzz z zzzz” instead of “Once upon a time”). According to Nuthmann and Engbert (2009:323) this paradigm originally followed the following logic:

Chapter 2: Eye tracking as a method to study reading and subtitling

In both conditions [reading and z-string scanning], eye movements will be influenced by roughly the same visual and oculomotor factors. If only low-level visuomotor variables and properties of the oculomotor system determine when and where readers move their eyes, then one would predict that the eye movements of readers who are reading normally (i.e. reading with full comprehension) will look very similar to those readers who are engaged in a mindless reading task like z-string scanning. In the latter case, the cognitive processes supporting comprehension are absent. Thus, if cognitive processes are driving eye movements in reading, then one might predict that eye-movement patterns of readers reading z-string will look different from those readers who are reading words.

This initial logic is deemed a bit flawed or idealized, as other components might be introduced during reading (cf. Nuthmann & Engbert, 2009). Although this logic does indeed account for certain differences between the two modes, there are also similarities. Among other things, for both normal reading and scanning, the length of the word or string of letters affects the fixation durations and fixation probabilities (Nuthmann & Engbert, 2009:334). These similarities are not too unexpected. Nuthmann and Engbert (2009:334-335) themselves comment on this by pointing out that “[t]here has never been evolutionary pressure to optimize reading abilities (i.e., humans did not specially adapt to reading).” Dehaene (2009:4) agrees with this and poses two questions central to what he has coined the ‘reading paradox’: “Why does our primate brain read? Why does it have an inclination for reading although this cultural activity was invented only a few thousand years ago?” (*ibid.*). From this he concludes that “[t]he reading paradox expresses the indisputable fact that our genes have not evolved in order to enable us to read.” (Dehaene, 2009:8).

Nuthmann and Engbert (2009:335) continue on the matter of reading and scanning by stating that “[t]herefore, in visual-cognitive tasks different from reading, many of the involved cognitive and oculomotor subsystems overlap or are even the same. What is unique about reading is that it engages both vision and language.” Certain key differences are discernable, however – when comparing reading to scanning, it was found that decisions about when and where to move the eyes are tied to word recognition, which is obviously absent in the strings of letters (Nuthmann & Engbert, 2009:335). This therefore rules out the possibility of pure motoric functions. It was also found that regressive saccades are to a large extent linked to lexical processing and higher-level word integration processes (*ibid.*). Vitu *et al.* (1995:353) add to this by stating that “neither the oculomotor nor the processing hypothesis is sufficient in itself to account for the oculomotor behaviour observed during reading”. Both elements are therefore present during reading. However, these elements of reading are, once again, more complex when considered in terms of

subtitling. The decision of where and when to move the eyes might not be as clear as for the reading of static text. For instance, in a study on eye movements during fiction and non-fiction film viewing, Tosi *et al.* (1997) found that participants prioritised movement over colour. Different types of film were shown to participants and it was found in fiction films, especially, that “eyes [were] more attracted towards an object in movement than towards a vividly colored object that was static” (Tosi *et al.*, 1997:50). When considering studies on the patterns of reading, a lack of in-depth research on the specific reading patterns of subtitle reading prevails. A few studies have addressed the issue and it has been found that regular reading occurs (cf. section 2.3.2), but no patterns of reading have been identified and established which take into account all the factors involved in the viewing of a film or television programme that contains both dynamic visuals and subtitles.

2.6 CONCLUSION

Although the reading of subtitles has been studied by means of eye tracking, it is not as prominent as other fields of study that have made use of this type of data to date. Eye tracking has been used in the fields of neuroscience, psycholinguistics, text reading and others much sooner and in a much more detailed fashion. According to Brasel and Gips (2008:1890), in general, “the perceptual process underlying television media consumption has been little explored”. Gale (2003:729), in his comments on eye movement studies used in communication and media applications, states that the topic of television and film subtitles is “a less well investigated area [...] – a complex area where potentially the observer can shift attention between the visual scene, the soundtrack and the subtitle.” Perhaps unknowingly, Gale is referring to one of the most important aspects of reading subtitles, one of many, in fact, that deserves more research and further investigation. d’Ydewalle and De Bruycker (2007:196) are a bit more specific in stating that “[n]ot much research has addressed the characteristics of eye movements when text and pictures have to be integrated”, which is exactly the challenge posed by reading subtitles.

In terms of research that has, to date, been conducted on subtitle reading and aspects of static text reading that are relevant to subtitle reading, this section has indicated that there are textual aspects of complexity (variables) that influence eye movements while reading; that these eye movements are indicative of ‘good’ and ‘bad’ reading; that fixation frequency and duration are indications of processing difficulty; that there are different constraints when reading subtitles as

Chapter 2: Eye tracking as a method to study reading and subtitling

opposed to reading static text (other competing sign systems, reading speed and the fleeting availability of the text to be read) and that these constraints might influence reading behaviour and eye movements; that there are aspects inherent to subtitles which might lead to differences in reading behaviour which in turn gives an indication of reading complexities experienced by the reader (number of lines, content, level of redundancy); and that the reading of subtitles occurs automatically, regardless of the language it is presented in or the viewer's familiarity with reading subtitles.

This section has also shown that a number of studies have been conducted on the benefits of subtitling and how it can facilitate second (and foreign) language acquisition. Likewise, many studies have been conducted on how people read foreign language subtitles and how it differs from reading native or first-language subtitles. The concepts 'second language' and 'foreign language' should, however, not be confused in this context – a foreign language is a language that is completely unknown to a viewer or viewers; a second language is a language that the viewer is familiar with and which can vary between viewers in terms of their level of proficiency. Studies on the reading of foreign language subtitles have frequently tested the automatic reading of subtitles based on the fact that the subtitles are read without actually being understood and without any reason for them being read (the viewers do not need to read the subtitles in order to comprehend the programme or film they are viewing because the audio track is available in their native language). Eye-tracking technology has been used in these studies on numerous occasions. Studies on the reading of second language subtitles, on the other hand, have been focused mainly on its application within educational environments and in terms of the benefits for second language acquisition and learning. The problem can therefore be stated as such: Although the findings of previous research are of great value and extremely useful, not much has been written specifically on the difference in eye movements when reading first and second language subtitles. In this regard there is a gap in the research that combines eye tracking with the reading and processing of subtitles.

Other aspects also require further attention in this combined field of research. These include the difference in reading printed material and subtitles – the differences in reading capabilities and reading behaviour could be measured by means of eye tracking and could lead to interesting insights. The same can be said of the true effect of subtitle presentation time on reading and comprehension.

Chapter 2: Eye tracking as a method to study reading and subtitling

In the introduction to this study the following research questions were stated:

- Are there differences between L1 and L2 subtitle reading among Afrikaans L1, English L2 participants?
- Are there differences between L1 and L2 subtitle reading among Sesotho L1, English L2 participants?
- What are the implications of the findings for the improvement of subtitling in South Africa for these language groups, and how do the findings affect the creation and implementation of future guidelines aimed at aiding the production of L2 subtitles in South Africa?

From the current overview of literature given in this section, these questions cannot yet be adequately answered. Firstly, one might say that it follows logically that there would be some degree of difference in L1 and L2 reading of subtitles, yes, but sufficient evidence has not been given by means of eye-tracking research on exactly what these differences are in terms of eye movement behaviour while reading the subtitles. The current study aimed to address this issue directly and give proof of either the difference in reading or the lack thereof. Secondly, apart from prolonging the presentation rate of subtitles for children to improve their recognition of subtitles, no research indicates the implications of results from eye-tracking studies for the creation and presentation of subtitles. In other words, previous studies have come to interesting conclusions but instead of applying their findings in practice, they've kept these findings within the domain of research. Or, put differently, few studies have originated from the need to improve aspects of subtitle presentation by examining how these changes (or the lack thereof) are perceived by viewers. Lastly, to date no eye-tracking research has been conducted on the reading of subtitles in South Africa or on the complexities of producing adequate second (or first) language subtitles for this multilingual environment. The experiment conducted for the current study set out to shed light on this issue and offer solutions in this regard.

The measures and findings of previous eye-tracking studies were applied to the current study and were kept in mind as the different phases of the study was completed in the hope of answering the research questions more adequately. As eye-tracking research presented new challenges and obstacles unknown to the researcher, much was also gained from studying the operationalization and methodology of these previous studies. In this regard, much was learned about the interpretation of eye-tracking data, such as that more and longer fixations are indicative of

Chapter 2: Eye tracking as a method to study reading and subtitling

processing difficulty and that more vertical shifts occur with two-line than one-line subtitles. Characteristics of subtitle viewing in general that were discussed in previous research have also been applied to the interpretation of results for the current study, such as that more time is spent reading two-line than one-line subtitles due to the textual complexity of the two-line subtitle and that one-line subtitles are often more redundant and therefore explains why less time is usually spent reading them. Eye-tracking data was gathered for analysis and most of these previous findings were again confirmed.

The next chapter will explain how the experiment was set up and how the data was gathered.

CHAPTER 3

Methodology

3.1 INTRODUCTION

The previous chapter has shown that countless studies have been conducted on reading. Whether it is the reading of static texts (printed material) or dynamic texts (audiovisual media such as subtitled film or television programmes), researchers have found certain shared characteristics. One relatively recent method commonly applied is the use of eye-tracking technology to study the eye movements of participants while reading. The outcome of this method is detailed data on exactly where people pause while reading (fixations), how long they pause for (fixation duration), how and where their eyes move (saccades and saccade position), and, in the case of studies on the reading of subtitles, the allocation and distribution of attention across the screen when simultaneously reading the subtitled text, listening to the audio track and viewing the dynamic visuals on-screen. There are many variables that influence the allocation and distribution of attention across the screen, the most significant of which is the ease with which the subtitles are read. In South Africa, subtitles are produced only in English, the second language (L2) of the majority of South African citizens. The aim of the current study was to examine how these English L2 subtitles are read by Afrikaans L1 and Sesotho L1 participants in order to find out whether English L2 subtitles are optimal for information access or if people tend to experience more difficulty with the L2 subtitles and miss out on the rest of the information conveyed through the sound or visuals because they have to focus on the reading.

The primary aim of this chapter is to describe the methods employed in order to answer the research questions formulated in Chapter 1, which is to find the differences between L1 and L2 reading of subtitles and to see what the implications of the findings are for the improvement of subtitling in South Africa; to see how the findings affect the creation and implementation of future guidelines aimed at aiding the production of L2 subtitles in South Africa.

This study followed a quantitative experimental model, using a seven-group (four test-group, three control-group) testing design. Participants were tested on their first and second language reading capabilities while their eye movements were recorded. Stimuli (materials) for the

Chapter 3: Methodology

experiment consisted of static text for reading as well as a subtitled short film to watch. The static text reading component was accompanied by a comprehension test, while participants were tested on their understanding of the content of the subtitled film at a very basic level by commenting on the moral of the story. A third component of the study was a survey on participants' language history, reading behaviour, language preference and subtitle reading experience and proficiency, which was conducted by means of a questionnaire. All data was analysed using descriptive and inferential statistics.

3.2 SETTING

The study was conducted at the Vaal Triangle Campus of the North-West University situated in Vanderbijlpark. The campus has grown significantly since the enrolment of the first full-time students in 1977 and now boasts student numbers bordering on 5 000 – according to the Institutional Plan 2011-2013, there are currently approximately 4354 active full-time students on campus and a further 887 students enrolled in distance learning courses (NWU, 2010a:15). According to a management report on the student enrolment counts for the Vaal Triangle campus (NWU, 2010b), 22.6% of the 4900 undergraduate students on campus are Afrikaans, 12% are English and 33.4% are Sesotho; and of the 322 postgraduate students, 35.5% are Afrikaans, 14.9% are English and 21.4% are Sesotho (Table 3.1).

Language distribution				
		Afrikaans	English	Sesotho
Undergraduate (4900 students)	Male	374	211	519
	Female	734	377	1120
	Total	1108	588	1639
		Afrikaans	English	Sesotho
Postgraduate (322 students)	Male	38	24	36
	Female	73	24	33
	Total	111	48	69

Table 3.1 The language distribution of Afrikaans, English and Sesotho students on the Vaal Triangle Campus of the North-West University (NWU, 2010b).

The campus has two faculties – the Faculty of Humanities and the Faculty of Economic Sciences and Information Technology. The School of Languages, a division of the Faculty of Humanities, recently acquired eye-tracking equipment and set up an eye-tracking laboratory where the experiment for this study was conducted. Local students from the campus volunteered for the

Chapter 3: Methodology

experiment and visited the laboratory in their own time – a timetable was set up and students could sign up for sessions at times that suited them. Only one participant could be tested at a time. The eye-tracking equipment is set up at one end of the room and consists of one computer connected to two monitors – a stimulus screen on which the stimuli are presented to the participants and the workstation monitor of the researcher. The eye tracker is connected to the computer and is set up in front of the stimulus screen where the participant is seated. The participant then views whatever is presented on the computer screen through the eye tracker. The researcher observes all characteristics of the participant's eye movements on the other monitor while the data is being recorded and stored as data files.

3.3 PARTICIPANTS

The aim was to conclude the experiment with 70 valid data sets distributed across 7 groups: four test groups (TAE, TEA, TSE and TES) and three control groups (CAA, CEE and CSS). A total of 91 students were tested, of which 69 were deemed valid.

3.3.1 Sampling

For this study, 91 students were selected from the Vaal Triangle Campus of the North-West University. A convenience sampling method was employed. Students were asked whether they knew what eye tracking was or whether they had heard of it before. A short explanation was given of what eye tracking entails, after which they were asked if they would like to participate in an eye-tracking experiment. Sessions were completely voluntary – if students did not turn up for their eye-tracking sessions, their names were crossed off the list. While the experiment was being conducted, problems that were encountered that became immediately apparent in the data were identified and the data sets concerned were discarded and new participant(s) acquired to replace the unusable data set(s). Such problems included participants' eyelids being naturally droopy and participants with downward-pointing eyelashes that obscured the pupil, leading to inaccurate calibration and/or eye-tracking data. In other cases calibration was successful, but during data capturing the data was visibly inaccurate – in these cases the experiment was stopped, the participant(s) thanked for being willing to participate and then excused. After having completed the experiment, one final data set had to be excluded from CEE due to invalid data. A replacement could not be found in time and the final number of participants was left at 69.

Chapter 3: Methodology

For test groups TAE and TEA participants were required to be Afrikaans mother-tongue speakers who spoke English as a second language and who had a limited to non-existing working knowledge of the French language. These participants viewed an animated French short-film with both L1 Afrikaans and L2 English subtitles but in alternating order. For test groups TSE and TES participants were required to be Sesotho mother-tongue speakers who spoke English as a second language and who had a limited to non-existing working knowledge of the French language. These participants viewed an animated French short-film with both L1 Sesotho and L2 English subtitles but in alternating order (cf. section 3.4 for more details).

Requirements for control group CAA were the same as for test groups TAE and TEA – participants were required to be Afrikaans mother-tongue speakers who spoke English as a second language and who had a limited to non-existing working knowledge of the French language. This group viewed the animated French short film with only L1 Afrikaans subtitles. Requirements for control group CSS, in turn, were the same as for test groups TSE and TES – participants were required to be Sesotho mother-tongue speakers who spoke English as a second language and who had a limited to non-existing working knowledge of the French language. This group viewed the animated French short film with only L1 Sesotho subtitles. For control group CEE participants had to be English mother-tongue speakers who had a limited to non-existing working knowledge of the French language. This group viewed the animated French short film with only L1 English subtitles (cf. section 3.4 for more details). The data collected for control group CEE was used for the comparison between English L1 reading and the English L2 reading of all test groups – test groups TAE and TEA in the Afrikaans experimental component of this study (Chapter 4) and test groups TSE and TES in the Sesotho experimental component of this study (Chapter 5).

Afrikaans L1 and Sesotho L1 participants were assigned to their respective groups by drawing a piece of coloured paper from a covered box – yellow for CAA, green for TAE and blue for TEA; orange for CSS, pink for TSE and red for TES. Group assignment was therefore random and unbiased. English L1 speakers were automatically assigned to control group CEE. Additional requirements for all participants were that they should not have any hearing or serious visual impairments – people with corrected to normal vision (people wearing glasses or contact lenses) were selected, but not in instances where vision was extremely impaired and the person wore very strong prescription glasses or contact lenses. Eye-tracking data collected from such a person would most likely be inaccurate and unusable because the lenses (due to their thickness or angle)

Chapter 3: Methodology

would deflect light to and from the eye-tracking camera and therefore not give an accurate account of where the person is looking (cf. section 3.5 for details on how the eye tracker records eye movements). This was found to be the case for participants wearing any form of prescription lenses.

3.3.2 Participant demographics

The only demographics used for the selection of participants were that participants had to have completed Grade 12 and either spoke Afrikaans, Sesotho or English as their home language. For two of the four test groups and the Afrikaans control group participants had to speak Afrikaans as their L1 and English as an L2. For the other two test groups and the Sesotho control group participants had to speak Sesotho as their L1 and English as an L2. The English control group was the only group that required participants to speak English as their L1.

3.4 MATERIALS

Three types of materials were used in testing the L1 and L2 reading capabilities of participants: static text, a subtitled short film and a questionnaire.

3.4.1 Static text

The static text reading component consisted of a text for reading and a standardised comprehension test. Both the text and the comprehension test were taken from the Academix™ programming software (http://www.zentium.co.za/Academix_Lees.htm) used to test students' reading and comprehension skills when first enrolling at the North-West University in what is known as the Reading Laboratory programme. This programme is compulsory for all students and aims to improve their reading from a basic school skill-level up to a level where they will be able to keep up with the academic reading that accompanies tertiary studies. This is done by giving students texts at various levels of complexity and at different reading speeds. Students start at level 8, which corresponds to Grade 8 reading ability, and are tested through to levels 11 or 12, which corresponds to Grade 11 and 12 reading ability. The aim is for students to reach a reading speed of 420 words per minute (wpm) at 80% comprehension as measured by the respective comprehension tests. If this target is reached by level 11, students do not have to continue to level 12.

Chapter 3: Methodology

Three texts were chosen for the current experiment, one Afrikaans, one Sesotho and one English, all corresponding to a basic Grade 12 reading level. The Afrikaans and English texts are not translations of each other. Each has its own structure and content, sharing only its instructional nature – the Afrikaans text explained the game Sudoku; the English text explained the game Rock, Paper, Scissors. The Sesotho text, however, is a translation of the Afrikaans text because an equivalent Sesotho text could not be found and was not available from the same source as the Afrikaans and English texts.²⁷ These texts (and levels) were chosen as such because they represent the basic reading level and capabilities that students should have when entering university. Test groups TAE and TEA read both the English and Afrikaans texts and completed the corresponding comprehension tests. Test groups TSE and TES read both the English and Sesotho texts and completed the corresponding comprehension tests. Control group CAA read only the Afrikaans text, control group CSS read only the Sesotho text, and control group CEE read only the English text. All three control groups completed only the comprehension test that corresponded to the respective language of the text. The text(s) were not presented according to predetermined reading speeds – participants were instructed to read at their own pace.

The complete Afrikaans, Sesotho and English texts as well as the corresponding comprehension tests are included as Appendices A to F to the thesis.

3.4.2 Subtitled short film

The subtitled short film was taken from a French learning initiative – a DVD with short films, some more definitely conveying a message than others, while the general aim is to create linguistic awareness through entertainment. The short film chosen for the current experiment is entitled *Tadeus* and is approximately 5 minutes in length. The original soundtrack of the short film is in French and English subtitles are provided.²⁸ These original English subtitles were used in cases where participants viewed the short film as either L1 or L2 English. For L1 Afrikaans

²⁷ As an added benefit, this made it possible to compare the Afrikaans and Sesotho reading data to the English reading data on the same level.

²⁸ It is not clear by whom the original subtitles were created, but the subtitles were found to be of a good standard: a maximum number of two lines was used; the subtitles were presented as white text with a black border; none of the subtitles contained more than 37 characters per line; two-line subtitles never remained on-screen for more than 6 seconds; and one-line subtitles remained on-screen with enough time for reading (they did not remain on-screen for too long, causing re-reading, nor did they flash because they were not on for long enough). The English subtitles were verified against the French dialogue by a French mother-tongue-speaking subtitler to ensure accuracy.

Chapter 3: Methodology

subtitles the original subtitles were translated from English to Afrikaans and back-translated to ensure accuracy and equivalence. This procedure was repeated for the creation of the L1 Sesotho subtitles. In order to make the reading of Afrikaans and Sesotho subtitles exactly comparable across the two experimental components, the Afrikaans subtitles were replaced by Sesotho subtitles, keeping the exact same formatting in terms of the number of lines – if the Afrikaans subtitle was a one-line subtitle, the Sesotho subtitle had to be a one-line subtitle, etc. The implication of this is that the Sesotho subtitles might not have been as optimal for the Sesotho participants as they would have been had there been no line or technical restrictions. The number of characters used per line, however, could not be retained and is therefore the only technical difference between the Afrikaans and Sesotho subtitles. This might have influenced the imposed reading speeds enforced on the participants, but this effect was found to be minimal (cf. section 5.3.1).

For test groups TAE, TEA, TSE and TES the short film was divided in half in terms of duration and content – a logical break in the storyline was selected as close as possible to the halfway point of the film’s total duration – and presented with either English, Afrikaans or Sesotho subtitles in the respective halves. Test group TAE viewed the short film with the first half subtitled in Afrikaans and the second half subtitled in English (hence the name TAE: T[Test]-A[Afrikaans]-E[English] in the data files). Test group TEA viewed the short film with subtitles in the reversed order, the first half being English and the second half Afrikaans (TEA: T[Test] -E[English]-A[Afrikaans]). Test group TSE viewed the short film with the first half subtitled in Sesotho and the second half subtitled in English (hence the name TSE: T[Test]-S[Sesotho]-E[English] in the data files). Test group TES viewed the short film with subtitles in the reversed order, the first half being English and the second half Sesotho (TES: T[Test] -E[English]-S[Sesotho]).

Control group CAA (C[Control]-A[Afrikaans]-A[Afrikaans]) viewed the short film with only Afrikaans subtitles; control group CSS (C[Control]-S[Sesotho]-S[Sesotho]) viewed the short film with only Sesotho subtitles; and control group CEE (C[Control]-E[English]-E[English]) viewed the short film with only English subtitles.



Figure 3.1 Screenshots of the short film, *Tadeus*, containing separate Afrikaans, English and Sesotho subtitles.

The subtitles were produced using Cavena Tempo subtitling software (www.cavena.com). The six-second rule was used as a guideline for subtitle presentation, with a maximum of 37 characters used per line as suggested by Díaz Cintas and Remael (2007:96).²⁹ Within the software the subtitle presentation rate was set at 15 characters per second, which corresponds to a reading speed of 180 words per minute (wpm). Based on the aforementioned settings the software automatically enforces a 37 character per line limit (including spacing and punctuation) while subtitling is in progress, and measures the time allocated for reading based on the number of characters within the individual subtitles and the chosen subtitle presentation rate. This is subsequently visualised for the subtitler by means of a reading speed indicator where the proportionate reading speed is presented on a scale varying from red to yellow – red indicates that too little reading time is allowed, green indicates sufficient reading time, and yellow indicates that too much reading time is allowed for the specific subtitle (see Figure 3.2). This

²⁹ Some subtitling institutions prefer to use a maximum of 32 characters per line, which corresponds to a slightly slower reading speed.

Chapter 3: Methodology

serves as a guideline for the subtitler to ensure that subtitle presentation stays as close as possible to the chosen presentation rate, but ultimately does not enforce it.³⁰



Figure 3.2 The reading speed indicator in Cavena Tempo indicating (a) too little reading time, (b) adequate reading time, and (c) too much reading time, calculated in terms of the presentation time of the subtitles (indicated by the arrows) and the number of characters in each respective subtitle.

The subtitles were displayed as white text with a black border and were presented at the bottom of the screen. A sans serif font, Helvetica, was used. The font size was 28 and a row spacing of 35 was set as the default distance between the baselines of two lines of text in a two-line subtitle. All subtitles in the short film, *Tadeus*, were marked as areas of interest (AOIs) for the purpose of data collection. They were marked on the basis of language (Afrikaans, English or Sesotho) and whether they were one or two-line subtitles. One-line subtitles were marked and named as AFR, ENG or SESOTHO 1.1, 1.2, 1.3, etc., depending on the number of subtitles. Two-line subtitles

³⁰ Analyses of the subtitles in the two components of this study revealed that, based on the average number of characters per word in the respective languages, the actual reading speeds at which Afrikaans one-line and two-line subtitles were presented were 144 and 175 wpm respectively (cf. sections 4.3.1 and 4.4.1.1) while Sesotho one-line and two-line subtitles were presented at 178 and 220 wpm (cf. sections 5.3.1 and 5.4.1.1). English one-line and two-line subtitles were presented at 135 and 175 wpm respectively.

Chapter 3: Methodology

were marked similarly (AFR, ENG or SESOTHO 2.1, 2.2, 2.3, etc.). The AOIs were marked using the BeGaze 2.5 AOI Editor and were displayed as coloured, semi-transparent blocks over the respective subtitles (Figure 3.3).



Figure 3.3 Afrikaans, English and Sesotho subtitles marked as areas of interest (AOIs) by means of coloured, semi-transparent blocks.

These blocks appeared and disappeared in synchrony with each individual subtitle. The AOIs were not visible to participants while viewing *Tadeus*; they were only visible on the researcher's monitor while viewing the recorded data after the participant(s) had left. Marking the subtitles as AOIs ensures the recording of eye-tracking data as focused on the AOIs (time spent in the AOI, number of fixations, fixation duration, etc.).

Prior to watching the short film, *Tadeus*, participants from both the test and control groups were shown a short subtitled segment from another short film, *Tong*, in order to acquaint themselves with the medium and the reading of subtitles and to ensure that the camera accurately measured and plotted the participants' eye movements within the subtitled area. The content of this preparatory clip and the data collected while viewing it are irrelevant – this was an additional control measure introduced by the researcher because, in the preparations for the experiment, it

Chapter 3: Methodology

had been found that sometimes the eye tracker transposed the fixations and saccades slightly above or below the subtitled area, despite accurate calibration (Figure 3.4). Showing this additional subtitled segment therefore gave the researcher the opportunity to pause the experiment if needed and make the necessary adjustments in participant placement or find the source of the problem before showing the participant the final stimulus film. If no problems occurred, the experiment automatically proceeded to the final stimulus, *Tadeus*.



Figure 3.4 Screenshot of what the researcher sees when regulating the accuracy of the eye tracker during the viewing of the preliminary subtitled film clip. The green dot indicates the correct positioning of a participant's eye; the blue and orange dots indicate inaccurate positioning.

A DVD with the different subtitled versions of *Tadeus* is included as Appendix H to the thesis.³¹

3.4.3 Questionnaire

The questionnaire used for the current experiment was based on questions drawn from two different experiments. The first is that of Coetzee-Van Rooy (2010b) in her study on the issue of multilingualism within higher education in South Africa. The questionnaire compiled by Coetzee-Van Rooy was issued to students at the Vaal Triangle Campus of the North-West University at the start of the 2010 academic year in order to collect data on students' linguistic orientation, language history and linguistic preference. The second experiment that questions

³¹ Permission was obtained from Cavilam and the French Ministry of Foreign affairs to use and publish *Tadeus* and *Tong* for non-commercial purposes as part of this study. However, as *Tong* was not a crucial part of this study, only *Tadeus* is included in Appendix H.

Chapter 3: Methodology

were drawn from is that of Veiga (2006); it formed part of her study on subtitling reading practices in Portugal which examined subtitle reading preferences and capabilities as measured against other forms of reading.

The questionnaire used for the current study consists of two major parts: the first part (Sections A and B) asks participants to indicate their biographical details (name, age, native language, level of schooling obtained and primary language in which schooling was received) as well as details on their language and language learning history. The first part of the questionnaire also includes an indemnity clause and permission to use the data anonymously in reporting the research findings. The second part of the questionnaire (Sections C and D) asks participants to elaborate on their reading and TV/film watching behaviour. This entails questions on their reading of printed material, reading habits, reading preferences, television viewing habits, familiarity with audiovisual material such as subtitled films and television, exposure to subtitled television material, reading preferences for subtitled television material, and their liking of films and television programming in general.

The complete questionnaire is included as Appendix G to the thesis.

3.5 EYE-TRACKING SYSTEM

3.5.1 Hi-Speed camera

An SMI iViewX™ Hi-Speed eye-tracking system (<http://www.smivision.com>) was used to monitor participants' reading behaviour while reading the static text and watching the subtitled short film. The Hi-Speed system is an integrated module with a built-in high speed camera and an ergonomic chin and forehead rest that keeps the test person's head in position in front of the camera (SMI, 2009a:184-185).

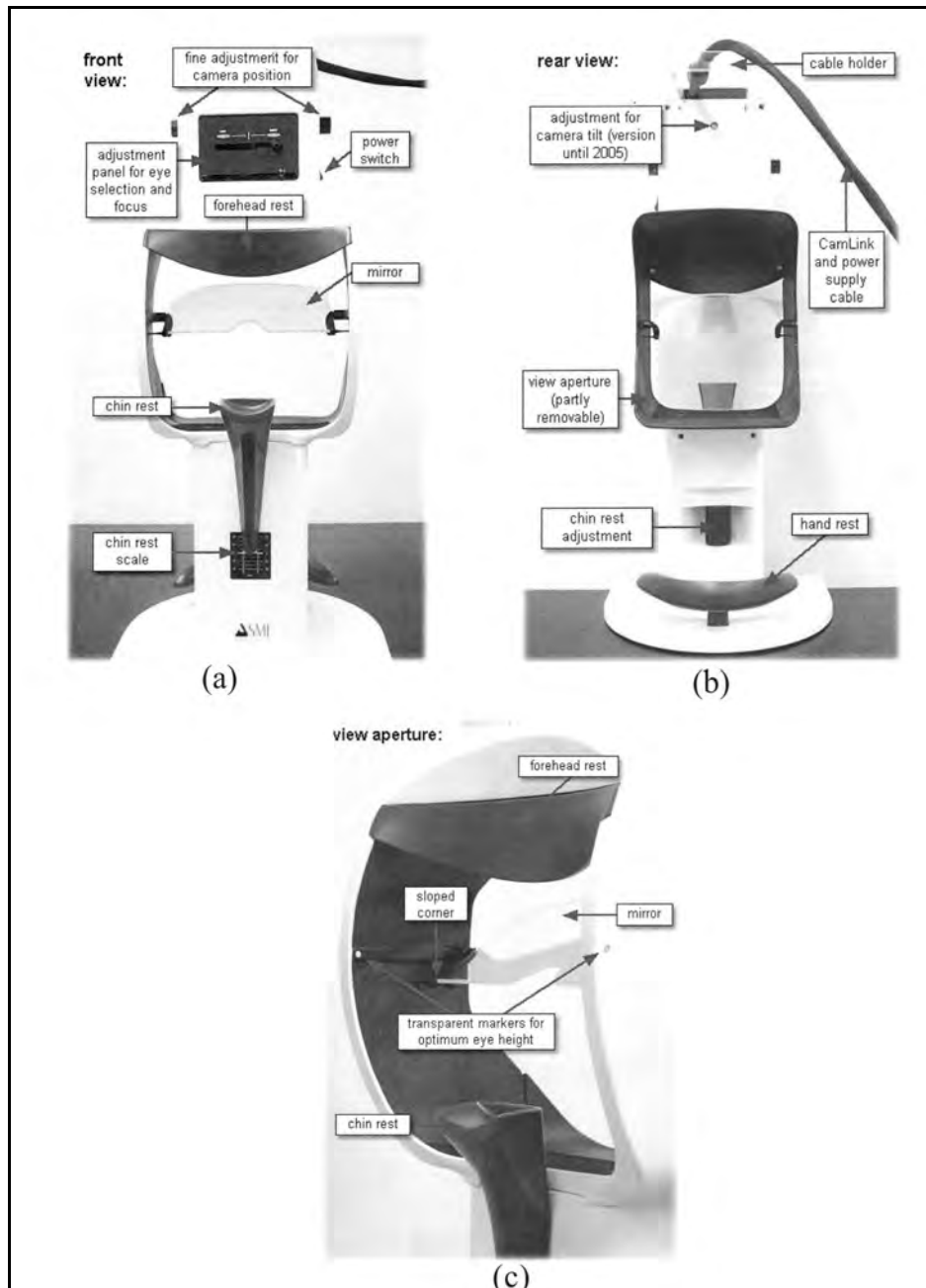


Figure 3.5 The SMI iViewX™ Hi-Speed eye-tracking column as seen from (a) the front, (b) the back, and (c) focusing on the view aperture with the chin and forehead rest (SMI, 2009a:186-188).

The Hi-Speed system is a dark pupil system using the pupil/corneal reflex method.³² The SMI iViewX™ System Manual (2009a:13) describes the dark pupil system as follows:

³² Because of the dark pupil system, female participants were asked to remove their mascara in some instances because the dark mass created by the mascara was sometimes mistakenly regarded as the pupil by the camera, causing the camera to jump from the pupil to the dark lashes. Eye-make-up remover pads were offered to those participants who were willing to remove their mascara; the make-up was then removed by the participants themselves.

Chapter 3: Methodology

The eye is illuminated by IR [*infrared*] light at an angle from an IR sensitive camera. The eye and face reflects this illumination but the pupil will absorb most IR light and appear as a high contrast dark ellipse. Sophisticated image-analysis software determines where the centre of the pupil is located and this is mapped to gaze position via an eye-tracking algorithm. Dark pupil systems are versatile and easier to set up though they also require some kind of head movement compensation.

The head movement compensation is done via the corneal reflex method which tracks one or several corneal reflexes “to compensate for changes in position of the camera relative to the head” (SMI, 2009a:14), in other words to differentiate between eye and head movements.

The Hi-Speed eye tracker used for the current study is a 500 Hz monocular system. It has a sampling rate of 500 Hz, which means that it takes 500 samples (photographs of the eye) per second, calculating the pupil position, pupil size and relative head movement. The Hi-Speed system makes use of a high speed event detection method with the saccade set as primary event, meaning that the built-in detector “will first search for saccade events, using a velocity based algorithm” (SMI, 2009b:191), after which “blinks and fixations are computed and derived from the primary saccade events” (*ibid.*). The system automatically classifies participants’ eye movements as fixations, saccades, and blinks. Minimum saccade duration is set as 22 ms with a peak velocity of at least 40° per second between 20% and 80% of event duration. Fixation duration between saccades is set at a minimum of 50 ms. A blink is regarded as a special kind of fixation where no eye data is present (SMI, 2009b:185). The data is processed in real time.

All participants were tested individually. They were seated comfortably in a sufficiently illuminated room, on a stable chair at a distance of 700 mm from the stimulus screen on which the text and film were to be displayed during the experiment. This is the suggested ideal distance for the size screen that was used (376 mm horizontally, 301 mm vertically). Each participant’s height was adjusted so that the participant’s eye was clearly visible and correctly placed in the eye image frame on the researcher’s monitor. This was done by adjusting the height of the chair, adjusting the height of the chin rest and adjusting the camera position vertically and/or horizontally using levers on the eye-tracking column. The focus of the camera was subsequently adjusted and after all settings were finalised, the experiment was initialised in Experiment Center 2.5. All stimuli were presented at a size of 1280 x 1024 pixels.

The first step in the experiment was a 13-point calibration. In the calibration, a dot moved across the screen and had to be fixated on 13 different points. The dot was displayed as a black outlined

Chapter 3: Methodology

circle on a grey background. Participants were instructed to focus on the centre of the dot and to follow the dot with their eyes only, keeping their heads as still as possible. After the 13 points were fixated, four validation points were given to ensure accuracy. The system calculates maximum deviation or error as 0.5° on the horizontal and vertical axis. If the maximum deviation was exceeded, a second calibration was performed. This was continued until calibration was successful. The calibration is an automatic and compulsory element for all experiments run in Experiment Center 2.5.



Figure 3.6 Screenshots of an inaccurate calibration (left) followed by a subsequent accurate calibration (right).

After having completed the calibration, participants were asked to (a) read a piece of static text; (b) watch the short introductory film segment to acquaint themselves with the medium and the reading of subtitles; and (c) watch the short film, *Tadeus*, in the same way they would at home. Participants viewed all material with normal binocular vision (i.e. with both eyes), but only the right eye was tracked for analysis.³³

³³ As was mentioned earlier, the Hi-Speed eye tracker used for the current study is a 500 Hz monocular system. It therefore does not allow for binocular eye tracking – even though participants view the presented stimulus material with both eyes, one can choose to track either the left or the right eye, but not both.

3.5.2 SMI Experiment Center™ 2.5

Experiment Center 2.5 is a component specific to SMI iViewX™ software and is used to prepare and execute experiments. It includes, amongst others, the following features as put forth by the SMI Experiment Center™ 2 Manual (2009c:11-12):

- A single user interface for managing various functions, including stimulus preview, live gaze monitoring, and precision timing.
- Integrated calibration including support for animated calibration targets and immediate validation of calibration quality.
- Text images, video, full length web sites, or interactive programs with screen recording can be displayed to each subject step by step while the subject's gaze position is monitored and gaze tracking data is recorded.
- An integrated data storage to allow the acquired data to be analyzed in the BeGaze [2.5] software.

In the preparation phase of the experiment, the relevant stimuli are chosen and inserted into Experiment Center 2.5, creating a type of storyboard of all the stimuli to be shown to participants. A calibration element is always automatically inserted as the first 'stimulus' to be shown to participants. All other stimuli are sorted according to the order in which they are to be presented. For the current study, seven separate experiments were created for the seven different groups. Although the order of stimuli can be randomized, this was the best way to ensure that no mishaps occurred during experiment execution. Depending on the group (test or control), all experiments contained the following stimuli: calibration, static text, calibration, preparatory subtitled film segment and the subtitled film, *Tadeus*. Additional calibration elements were inserted to ensure accuracy after participants completed the comprehension tests to make sure the system was still accurate in measuring their eye movements before showing them the subtitled film(s).

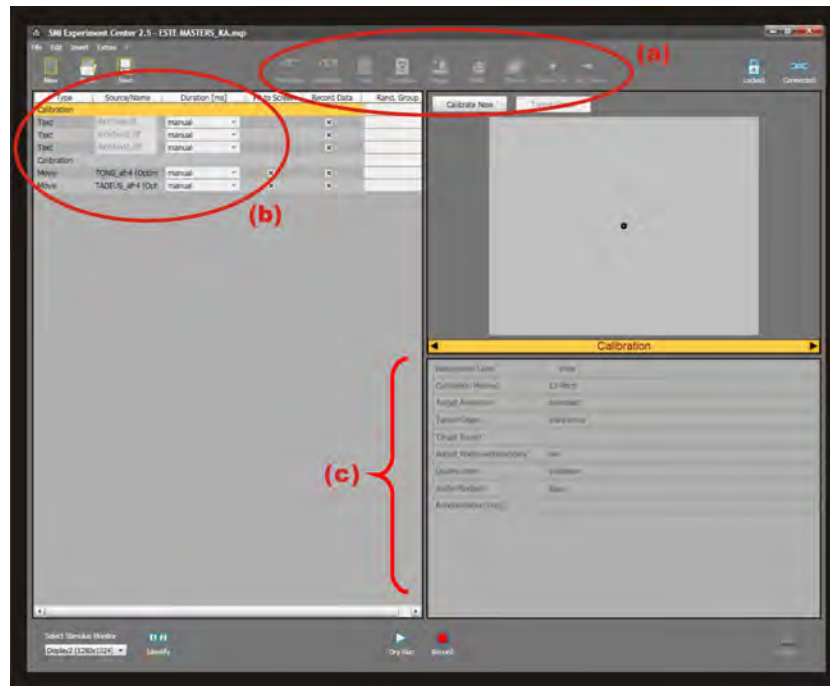


Figure 3.7 Screenshot of the Experiment Center 2.5 user interface showing (a) the different stimuli options that can be inserted into an experiment, (b) the stimuli selected for the Afrikaans control group (CAA) including the compulsory calibration (marked in yellow), and (c) calibration settings.

During the execution of the experiment, the stimuli were shown to each participant individually on the stimulus screen while the researcher observed and monitored the experiment on a second computer monitor. The data was recorded in real-time and automatically stored in an experiment directory for analysis.

3.5.3 SMI BeGaze™ 2.5

All data was captured automatically in real-time and analysed afterwards using SMI BeGaze™ 2.5. Like Experiment Center 2.5, BeGaze 2.5 is a component specific to SMI iViewX™ software and is used for behavioural and gaze analysis of eye-tracking data (SMI, 2009b:2). It simplifies the analysis of the data by automatically grouping data based on individual experiments and participants. BeGaze 2.5 allows for simultaneous analysis, the use of various stimuli, handling multiple participants, presenting data by means of smart visualizations, optimizing workflow and interaction, defining static and dynamic areas of interest, exporting data tables for statistical analysis, and easy integration with Experiment Center [2.5] for easy experiment execution (SMI, 2009b:8-11).

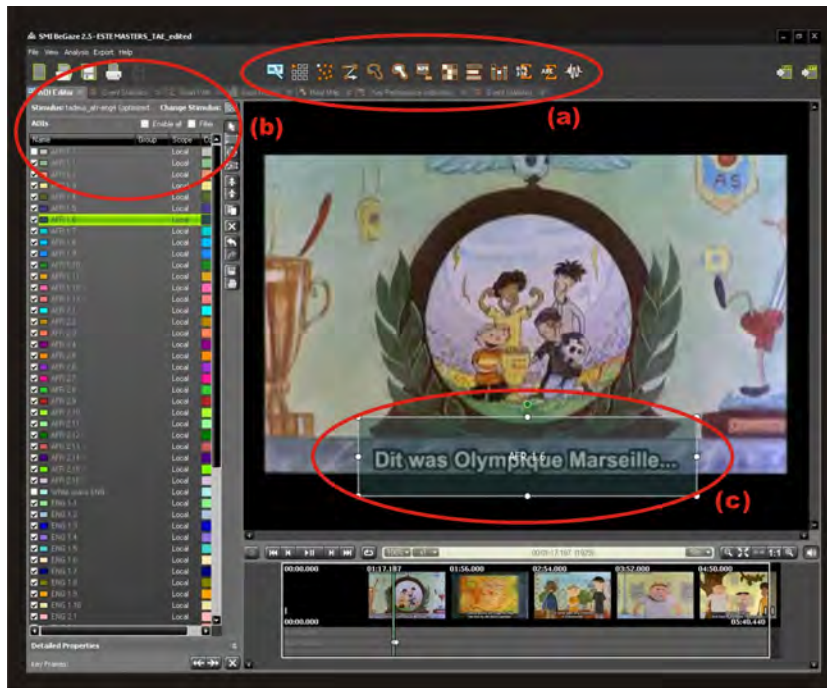


Figure 3.8 Screenshot of the BeGaze 2.5 user interface showing (a) the different smart visualization options, (b) an area of interest tab opened for creating and editing areas of interest, and (c) a subtitle marked as an AOI.

The smart visualizations are particularly useful for initial analysis of data. They include gaze plots, attention maps and real time statistics such as key performance indicators. The gaze plots (scan path or bee swarm) allow one to view the gaze path of participants as a video; it therefore provides an accurate qualitative replication of where the participants looked, what they looked at first and for how long. The attention maps, in turn, give a more accurate account of what was observed and what not. Although these visualizations cannot be used for in-depth analysis, they still offer insight into the viewing behaviour of participants in a way that is easily understandable.

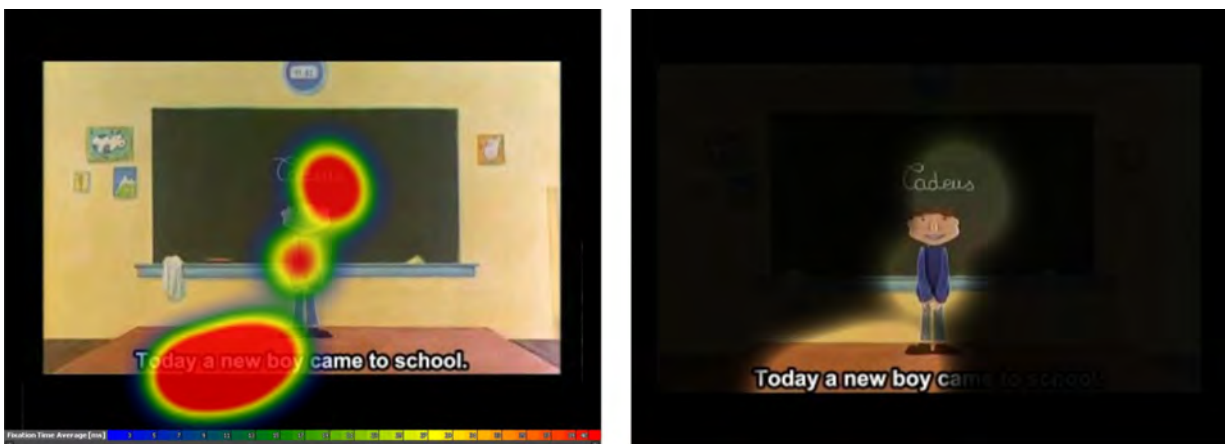


Figure 3.9 Screenshots of a heat map video (left) and a focus map video (right) indicating where participants focused during viewing of the subtitled film.

Chapter 3: Methodology

The use of area of interest (AOI) definition was of great use for the current study. As mentioned before, all subtitles were marked as AOIs. This meant that eye movements were measured specifically in terms of the subtitles, providing valuable data that would otherwise not have been obtainable. When AOIs are defined, BeGaze 2.5 automatically groups the eye-tracking data per AOI. An added benefit here is that one can create the AOIs after the experiment has been conducted – it is not something that can alter the experiment if it was not done beforehand. BeGaze 2.5 was designed to regroup the data based on definitions and selections made after the experiment had been conducted.



Figure 3.10 Screenshots of a scan path video indicating the order in which a participant read a subtitle by means of fixations (circles) and saccades (connection lines). The longer the fixation duration, the bigger the circle.

3.6 DATA COLLECTION / PROCEDURE

All materials were issued to participants individually. The experiment was conducted over a period of two years, with participants booking one individual session each on a day and at a time that suited them best. Only one participant could be tested at a time. Each participant viewed the materials in this one session, in successive order. The static text for reading was issued first, followed by the subtitled short film and then the questionnaire on language history, subtitle reading experience and proficiency.

3.6.1 Preliminary

When participants arrived at the eye-tracking laboratory, they were welcomed and showed around the laboratory and showed the equipment without elaborating too much on the purpose of the experiment they were about to take part in. The first step in the experiment was for each participant to draw a piece of coloured paper from a closed container – this would determine to which group they would be assigned (test group TAE, test group TEA or control group CAA for Afrikaans L1-speaking participants; test group TSE, test group TES or control group CSS for Sesotho L1-speaking participants). If the participant was an English mother-tongue speaker, he/she was automatically assigned to control group CEE. Participants were informed that they were to read a text, watch a short animated film and complete a questionnaire on their language history and reading behaviour (no reference was made in advance to the reading of subtitles to avoid influencing their natural reading of the subtitles). Participants were also told about an informed consent form that was to be signed afterwards and asked if they had any objections before the experiment started. The informed consent form was issued afterwards because it contained detailed information on the experiment and would therefore have biased participants towards the nature of the experiment if they were to read it before the experiment was conducted. The consent form was issued as the cover page of the questionnaire to ensure that it was indeed signed by every participant.

3.6.2 Reading of static text

Each participant was seated in front of the Hi-Speed Eye-tracker with his/her chin on the chin rest and forehead resting against the forehead rest. After having made the necessary height and

Chapter 3: Methodology

focus adjustments and completing the compulsory 13-point calibration, participants were instructed to remain in this seated position until instructed otherwise.



Figure 3.11 A participant seated at the Hi-Speed eye tracker in front of the stimulus screen.

Texts for reading and the accompanying comprehension test(s) were issued individually and in successive order if more than one text was to be read – the group that a participant was assigned to determined which text was to be read and in which order. Participants belonging to test group TAE read an Afrikaans and an English text – the Afrikaans text and comprehension test were read and completed first, followed by the English text and comprehension test. Test group TEA was given the English text and comprehension test first, followed by the Afrikaans text and comprehension test. This procedure was also followed for participants in test groups TSE and TES: participants belonging to test group TSE read a Sesotho and an English text – the Sesotho text and comprehension test were read and completed first, followed by the English text and comprehension test. Test group TES was given the English text and comprehension test first, followed by the Sesotho text and comprehension test. Control group CAA was given only the Afrikaans text and comprehension test, control group CSS was only given the Sesotho text and comprehension test, and control group CEE was only given the English text and comprehension test.

After each respective text was read (Afrikaans, Sesotho or English), participants were instructed to move back from the eye tracker and complete the comprehension test on the multiple-choice questionnaire provided. If a second text was to be read (as was the case for the four test groups), calibration had to be repeated before the new text was presented. The whole procedure was repeated as before, ending with the completion of the second comprehension test.

3.6.3 Subtitled short film

The subtitled short film, *Tadeus*, was presented after the last comprehension test was completed. As before, each participant was seated in front of the Hi-Speed Eye-tracker with his/her chin on the chin rest and forehead resting against the forehead rest. If needed, the participant's height was re-adjusted so that the participant's eye was again clearly visible and correctly placed in the eye image frame on the researcher's monitor. At this point, no major adjustments needed to be made as this was a continuation of the experiment and no settings had been altered. After all settings were finalised, the experiment was continued in Experiment Center 2.5, starting once again with the 13-point calibration. Participants were instructed to remain in this seated position until instructed otherwise.

After having completed the calibration, participants were shown a short subtitled segment from the short film, *Tong*, to acquaint themselves with the medium and the reading of subtitles in preparation for the final part of the experiment. Following this, all groups were shown the same French animated short film, *Tadeus*, but with different subtitles as per respective test or control group. To recap, test group TAE viewed the film with Afrikaans and English subtitles, the first half of the film being subtitled in Afrikaans and the second half in English. Test group TEA also viewed the film with Afrikaans and English subtitles, but with the subtitles in the reversed order of how they were shown to test group TAE. Test group TSE viewed the film with Sesotho and English subtitles, the first half of the film being subtitled in Sesotho and the second half in English. Test group TES also viewed the film with Sesotho and English subtitles, but with the subtitles in the reversed order of how they were shown to test group TSE. Control group CAA viewed the film with only Afrikaans subtitles, control group CSS viewed the film with only Sesotho subtitles, and control group CEE viewed the film with only English subtitles. After having viewed the whole film, participants were instructed to move back from the eye tracker. All participants, regardless of group, then had to write a short paragraph on what they thought was the central message or lesson conveyed by the film. The purpose of this was to ensure that participants really watched the film with the aim of understanding it; to ensure that they were focusing on the film and not just sitting there, watching the film and thinking of something else.

This phase of the experiment concluded the use of the eye tracker. After having completed this phase, participants were asked if they wanted to see what the eye tracker had recorded, in which case the experiment was explained and illustrated.

3.6.4 Questionnaire

The questionnaire was issued after participants had completed all the other phases of the experiment. The purpose of the questionnaire was explained within the context of the experiment and participants were given a quick run through the sections and questions. The consent form was explained in detail and completed first. As the questionnaire was quite extensive, participants were offered two options – they could either complete the questionnaire in the experiment room where they were, or they could take it home and return it within one day. Participants opted for both options, depending mostly on whether or not they had to attend a class immediately after their experiment session.

3.7 DATA ANALYSIS

This section will discuss the methods of data analyses used for the different components of the study and will be presented in terms of primary and secondary data. The primary data constitutes the data collected for subtitle reading, as this is the main focus of the current study. The secondary constitutes possible confounding variables that might have influenced or explain participants' subtitle reading, including participants' reading of static text and their responses to the questionnaire.

3.7.1 Primary data: subtitle reading

Data was automatically recorded in real time via the SMI iViewX™ system. The data was viewed and analysed in BeGaze 2.5, after which it was exported to Excel and Statistica for further analysis.

The SMI iViewX™ system (by means of Experiment Center 2.5 and BeGaze 2.5) calculates a vast amount of data – one needs to work through it and identify those parameters most relevant to the study at hand. For the current study, the focus was on count and duration parameters. The count parameters included fixation count, glances count and revisitors count, and the duration parameters included dwell time total and fixation time total. As the aim of the study was to examine the reading of subtitles, the subtitles were considered and marked as areas of interest and all data was recorded and measured in accordance to them.

Chapter 3: Methodology

Two aspects were studied: the differences between groups and the differences between factors in order to examine where the difference(s) in reading lay, if such differences were found. In other words, the differences between test and control group data were examined as well as the differences within the groups (the different factors) to find smaller differences or details that might have been missed or overshadowed by larger scale normalities. These ‘different factors’ are the halves of the film (first half versus second half), the number of lines (one-line or two-line subtitles), and also language (Afrikaans, Sesotho or English).

The **dependent variables** for this study were the duration parameters (fixation time total and dwell time total) and count parameters (fixation count, glances count and revisitors count), all of which were measured according to the areas of interest (AOIs), the subtitles. The **independent variables** for this study were the condition (test or control), language (Afrikaans, Sesotho or English), halves of the film (first or second half) and lines (one-line or two-line subtitles). The importance of choosing the duration and count parameters as dependent variables lies in the insight they offer – they are indicative of processing difficulty (also referred to as absorption in the current study) as well as interaction with the visuals on-screen, in other words how participants observe the subtitles in relation to the rest of the visuals that accompany them, specifically in terms of vertical movement to and from the subtitled area.

Absorption is indicated by the duration parameters fixation time total and dwell time total, as well as the count parameter fixation count. These parameters were chosen based on the use in previous studies and in terms of previous findings. It was stated in Chapter 2 (cf. section 2.1.2) that fixation durations are considered an indication of processing difficulty (Just & Carpenter, 1980; Praet *et al.*, 1990; McConkie & Yang, 2003; Morris & Williams, 2003; Liversedge *et al.*, 2004; d’Ydewalle & De Bruycker, 2007; Perego, 2008; SMI, 2009b). Therefore fixation duration was included as a dependent variable to measure participants’ processing of the subtitles. However, it is not the fixation durations of the individual fixations that are measured here, but the combined duration of all fixations in any given subtitle. The result is therefore an indication of overall processing of any given subtitle. The other duration parameter, dwell time total, is related to fixation time total but instead of measuring only the fixations, saccade durations are also included, thus giving an overall indication of the amount of time spent in the subtitled

Chapter 3: Methodology

area.³⁴ The decision to use dwell time as a measure of processing is in agreement with Vonk and Cozijn's (2003:294) notion that saccades are part of language processing and should therefore not be excluded from measuring reading time and the processing of what is read (cf. section 2.1.3). The frequency of fixations is also regarded as an indication of processing difficulty because the more fixations are made in a subtitle, the more time is spent in that subtitle; therefore fixation count is included as a measure of absorption.

Vertical movement is indicated by the count measures glances count and revisitors count. Both these parameters relate to a subtitle being visited and then revisited by making subsequent glances back to the subtitled area after having visited it for the first time. As noted in Chapter 2 (cf. section 2.3) De Linde and Kay (1999:17) argue that, for a subtitled programme, it is not possible to process the text (subtitles) and visuals at the same time; they have to be processed in succession, which implies that the viewer's attention has to be "divided between processing the image and reading the subtitles". This is done by literally shifting the attention between the subtitled area at the bottom of the screen and the rest of the visuals above it; hence the term 'vertical movement'. Numerous findings have indicated that the shift between subtitles and the rest of the visuals occurs almost automatically (cf. section 2.3.1). d'Ydewalle and De Bruycker (2007:197) refer to these movements simply as "the back and forth shifts between visual image and subtitle". These shifts were measured as the "number of saccades from a fixation in the visual image to a fixation in the subtitle area" (d'Ydewalle & De Bruycker, 2007:199; cf. section 2.3.1). This corresponds to the description of a glance as used in the current study. In terms of revisitors count, the second parameter used to indicate vertical movement, d'Ydewalle and De Bruycker (*ibid.*) also excluded the first visit to the subtitle after its appearance from their calculations.

The number of lines in a subtitle was included as independent variable based on the vast amount of attention it has received in previous eye-tracking research (cf. section 2.3.2). The most significant findings in terms of one-line and two-line subtitle reading are that proportionally (a) more time is spent reading two-line than one-line subtitles (corresponding to more fixations and longer fixation duration), (b) fixations were shorter in one-line than in two-line subtitles, (c)

³⁴ Time spent in the subtitled area is a valuable measure because of the presence of other visual information – in terms of attentional demand, significant insights have been gained by studying the time spent in the subtitled area as opposed to time spent in other parts of the screen (cf. section 2.3.1).

Chapter 3: Methodology

more reading occurs with two-line than with one-line subtitles, and (d) more vertical shifts occur with two-line subtitles than with one-line subtitles. These findings were taken as measures to be compared between L1 and L2 reading of the subtitles for the current study. Another aspect to be tested was the possibility suggested by d'Ydewalle *et al.* (1991:657) that the presentation time allocated to one and two-line subtitles respectively might influence how the subtitles were read, meaning that participants might have taken more time to read two-line subtitles not necessarily because they needed more time, but because more time was available. Subtitle length (word and character counts) was also taken into account to determine an estimated reading time per word and used for correlations within and between groups.

All eye-tracking data was analysed using Statistica. ANOVAs were used to test for significant interactions between language and condition (test or control), in other words on combined parameters. The cut off point for p-values was set at $p < 0,05^*$ and $p < 0,01^{**}$. Cohen's effect size was used to determine practical significance based on the following scale (Cohen, 1977:20-27):

d = 0,2 small effect size

d = 0,5 medium effect size

d = 0,8 large effect size

This yielded valuable results but further exploration was required in most instances. T-tests were then administered to test for significant differences between averages on individual parameters in the separate conditions.

3.7.2 Secondary data: confounding variables

The secondary data constitutes the data collected for participants' reading of static text as well as their responses to the questionnaire to be analysed as possible confounding variables. In other words, this data consists of potential independent variables that might also underlie the observed differences in the dependent variables. It is therefore important to control for their effect. As part of the analyses, the possible influence of each confounding variable on the primary findings was judged according to three criteria. In order to explain these criteria, an idealised hypothetical example will be used. In this example, participants' level of education (whether they were undergraduate or postgraduate) will be analysed in accordance with the findings for subtitle reading. The group names for the Afrikaans component of the study will be used for the sake of

Chapter 3: Methodology

illustration: TAE (Test-Afrikaans-English), TEA (Test-English-Afrikaans), CAA (Control-Afrikaans-Afrikaans) and CEE (Control-English-English) (cf. section 3.4 for more details regarding group names).

The **first criterion** was evidence of a statistically significant effect – if a variable was found to have a statistically significant relationship with the dependent variable, it was analysed further. If not, it was ruled out as an influence on subtitle reading, refuting the alternative hypothesis that the difference in subtitle reading could be attributed to confounding variables. In the hypothetical example, participants' level of education was found to have had a significant effect on subtitle reading ($p < 0.05$), which means that the effect of this variable needs to be analysed further.

The **second criterion** was the variables' relation to the primary findings – the variables had to have had a meaningful relationship in the hypothesized direction with the primary findings, meaning that the variables' relation had to imply an advantage for the reader in terms of subtitle reading. If the relation was found to offer a meaningful alternative, the variable was analysed further. If not, it was ruled out as an influence on subtitle reading, refuting the alternative hypothesis that the difference in subtitle reading could be attributed to confounding variables. In the hypothetical example, it was found that an increase in participants' level of education improved their subtitle reading – the postgraduate students processed the subtitles much easier than the undergraduate students. This was an expected finding, as one would expect students who have studied for longer to have better reading skills. The relation was therefore linear and in the hypothesized direction, which means that the effect of this variable needs to be analysed further.

The **third and final criterion** was the distribution of respondents as measured by crosstabulations. In order to support the hypothesis that subtitle reading does not differ because of L1 and L2, the distribution of participants had to agree with the observed difference in subtitle reading, which was that CEE and TEA processed the English subtitles with the same ease during the first half of the film ($CEE_1 = TEA_1$) and that TAE spent more time processing the English subtitles than CEE during the second half of the film ($TAE_2 > CEE_2$). In other words, when considering the distribution of findings for the respective variables, the number of participants in the groups had to have selected their responses in such a way that it satisfied these conditions. If the distribution patterns were found to be similar, the research hypothesis was supported – the variable greatly influenced participants' subtitle reading. If not, the hypothesis was refuted,

Chapter 3: Methodology

leaving the difference between L1 and L2 reading as the only explanation for the primary findings. In the hypothetical example, participant distribution was found to agree with the observed difference in subtitle reading (Table 3.2).

Level of education						
Rating	Dwell time [ms] (means)	Fixation time [ms] (means)	CAA	CEE	TAE	TEA
1	2297.488	1930.051	7	0	9	1
2	1503.321	1200.361	3	9	1	9
All Groups			10	9	10	10

Table 3.2 Hypothetical example: Crosstabulations of level of education for the respective groups based on the number of subtitles read per participant. The means are also given for dwell time and fixation time per category rated 1 (undergraduate) or 2 (postgraduate) as calculated by means of ANOVAs.

From Table 3.2 it is clear that the distribution of participants across the different groups was not equal – control group CEE consisted of only postgraduate students (9), whereas test group TAE consisted of 9 undergraduate students and only 1 postgraduate student. This would explain why CEE processed the English subtitles much easier than TAE (i.e. $TAE_2 > CEE_2$). Test group TEA consisted of 9 postgraduate students and 1 undergraduate student, which would also explain why TEA processed the English subtitles with the same ease as CEE (i.e. $CEE_1 = TEA_1$). Participant distribution therefore satisfied both the underlying conditions needed to pass the third criterion. Because all three criteria were passed (statistically significant effect, linear relation and participant distribution), the conclusion to be made is that the differences found in subtitle reading for groups TAE and CEE were not due to L1 and L2 reading, but rather participants' level of education. The research hypothesis was therefore refuted by a confounding, alternative explanation for the findings.

In other words, variables had to pass all three criteria in order to be considered justifiable influences on subtitle reading that could refute the research hypothesis that subtitle reading differs for L1 and L2. The application of these criteria was straightforward for Afrikaans and English subtitle reading (Chapter 4) but was slightly more complex for Sesotho and English subtitle reading (Chapter 5) as the scope of the findings was much greater.

3.7.2.1 Reading of static text

Data was automatically recorded in real time via the SMI iViewX™ system and was viewed and analysed in BeGaze 2.5. Participants' reading speeds (measured as words per minute) for the

Chapter 3: Methodology

respective Afrikaans, Sesotho and English texts as well as their test scores (calculated as a percentage value) for the corresponding comprehension tests were used for statistical analysis. Statistica™ (<http://www.statsoft.co.za>) was used to perform correlations with the eye-tracking data for subtitle reading in order to find significant interactions. The cut off point for p-values was set at $p < 0,05^*$ and $p < 0,01^{**}$. Cohen's effect size was used to distinguish between degrees of significance as put forth in the following scales (Cohen, 1969:76-77):

$r = 0,1$ small effect size

$r = 0,3$ medium effect size

$r = 0,5$ large effect size

The reading speed for static text reading was analysed for three purposes – to find correlation(s) between reading speed and subtitle processing (absorption), reading speed and vertical movement, and reading speed for static text and reading speed for subtitles. The correlation between reading speed and subtitle processing was the primary analysis – it was used to determine whether participants' reading speed could have influenced their subtitle reading to such an extent that it (a) might explain the differences found in the eye-tracking data and (b) might rule out the possibility that subtitle reading differed because of L1 and L2 reading. In order to determine this, the findings for participants' reading speed for static text reading were judged against the three criteria as mentioned above: statistically significant effect, linear relation and participant distribution. All three these conditions had to be satisfied in order for reading speed to explain the differences found for subtitle reading.

3.7.2.2 Questionnaire

Data gathered from the questionnaire was analysed based on relevance – questions that might relate to participants' subtitle viewing and which could explain the eye-tracking data for subtitle reading were analysed by means of correlations. The questions that were used include questions on participants' reading and television viewing habits and their subtitle reading preference. Participant demographics were also included. Answers to these questions were recoded to facilitate data analysis.

Chapter 3: Methodology

Correlations were performed in order to find significant interactions. The cut off point for p-values was set at $p < 0,05^*$ and $p < 0,01^{**}$. Cohen's effect size was used to distinguish between degrees of significance as put forth in the following scales (Cohen, 1969:76-77):

$r = 0,1$ small effect size

$r = 0,3$ medium effect size

$r = 0,5$ large effect size

Reading and television viewing habits

Participants were asked to state how many times per week they read for fun and read for their studies respectively. These two questions were combined to one category (Reading per week), and answers were rated from A (none to very few times per week) to C (many times per week). The same was done for subtitle viewing – participants were asked to state how many times per week they watched subtitled television or films respectively. These two questions were combined to one category (Read subtitles per week), and answers were again rated from A (none to very few times per week) to C (many times per week). Participants were also asked how many times per week they watched television in general; answers were again rated from A (none to very few times per week) to C (many times per week).

Television viewing and subtitle reading preference

Participants were asked to rate the extent to which they liked or disliked watching certain television programmes. They were asked to rate them from 1 (dislike) to 4 (like). This was asked of both local and imported programming. 'Soap operas' was the only genre chosen for the correlation analyses because it is the type of programming that is most frequently shown on South African television and most easily accessible in terms of different television networks. Participants were also asked to rate how often they read L2 subtitles on a scale from 1 (not a lot) to 4 (a lot) and how much they liked to read subtitles on television, also on a scale from 1 (dislike) to 4 (like).

Participant demographics

No participant graphics were used for analyses. Demographic aspects (age, gender, race, etc.) showed too little variance to have been influencing variables. These demographics are reported, but only to describe the participant group and not in terms of statistical relevance.

Participants' responses to the questionnaire questions were used to determine whether the respective variables could have influenced their subtitle reading to such an extent that it (a) might explain the differences found in the eye-tracking data and (b) might rule out the possibility that subtitle reading differed because of L1 and L2 reading. In order to determine this, the questionnaire data was judged against the three criteria as mentioned above: statistically significant effect, linear relation and participant distribution. For each confounding variable all three these conditions had to be satisfied in order for that variable to explain the differences found for subtitle reading.

3.8 CONCLUSION

When considering the study as a whole, the following experimental measures were applied: using an SMI iViewX™ Hi-Speed eye tracker to measure participants' eye movements while reading static text and watching a subtitled film; measuring participants' comprehension of the static text with a multiple-choice comprehension test; and gaining insight into participants' reading and subtitle viewing habits and preferences by means of a questionnaire. All data was exported to Excel, prepared for statistical analysis, and analysed in Statistica.

Participants' reading speeds, comprehension scores, as well as their answers to the questionnaire were correlated with the eye-tracking data for subtitle reading to find possible explanations for the differences found. For this purpose, the eye-tracking data and findings for subtitle reading were considered primary data while static text reading and questionnaire responses were considered secondary data. The primary data was first analysed to report on participants' subtitle reading and find possible differences. The secondary data was then analysed along with the primary data by means of ANOVAs, correlations and crosstabulations to find out whether any of the confounding variables could have influenced the subtitle reading and thus explain the differences that were found.

Chapter 3: Methodology

The next two chapters will present and discuss the empirical findings of this study as well as all results drawn from the analyses. The first chapter, Chapter 4, will focus on the findings for the Afrikaans L1-speaking participants (test groups TAE and TEA and control group CAA) as compared to the English L1-speaking control group CEE. The subsequent chapter, Chapter 5, will in turn focus on the findings for the Sesotho-L1 speaking participants (test groups TSE and TES and control group CSS) as compared to the English L1-speaking control group CEE. The findings for the Sesotho L1-speaking participants will also be compared to the findings for the Afrikaans L1-speaking participants in Chapter 4 in order to point out specific similarities and differences in the data.

CHAPTER 4

Analysis and interpretation of empirical findings for Afrikaans L1 speakers

4.1 INTRODUCTION

This chapter presents the results of the analyses of the eye-tracking and questionnaire data to identify and explain the difference(s) found in the reading of L1 and L2 subtitles by Afrikaans L1 speakers.

The findings are presented and discussed in two main categories dealing with primary and secondary data respectively. The primary data comprises the eye-tracking data for the viewing of the subtitled material and are presented in terms of the analyses of both dependent and independent variables. The dependent variables were the key eye-tracking parameters that indicate processing (fixation time total, dwell time total, fixation count) and vertical movement (glances count, revisitors count). The independent variables were factors from the experimental design, namely language (Afrikaans or English), condition (test or control), the number of lines in the subtitle (one-line or two-line subtitle) and halves of the film (first or second half).

The hypotheses for the current study were as follows:

H₀: There is no difference in subtitle reading in and between the different groups.

H_R: There are differences in subtitle reading for these groups and the differences are attributed to L1 and L2 subtitle reading.

H_A: There are differences in subtitle reading for these groups but the differences are attributed to other factors and/or influences, and not L1 and L2 reading.

The findings for the analysis of the primary data refuted the null hypothesis that there is no difference in the reading of L1 and L2 subtitles. This is referred to as the primary finding. Secondary data was subsequently analysed in order to support the alternative hypothesis that the difference in subtitle reading was attributed to confounding variables and not L1 and L2 reading. The secondary data comprises participants' responses to questions on their reading habits and preferences as gathered from the questionnaire, as well as the results of their reading of static

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

text (reading speed and comprehension score). The findings of the analyses of the secondary data are referred to as secondary findings. The secondary findings did not provide an alternative explanation for the differences found in the eye-tracking data for subtitle reading, therefore supporting the research hypothesis that the differences in subtitle reading are attributed to L1 and L2 reading.

However, before delving too deep into the data, data analyses and findings, it is important to have more information on the particulars of the participants who took part in the study.

4.2 PARTICIPANT DEMOGRAPHICS

A total of 47 participants were initially tested for this part of the experiment. After excluding invalid data sets, 39 participants remained. Of these, 30 were Afrikaans L1 speakers distributed across three groups – test groups TAE and TEA, and control group CAA. The remaining 9 participants were all English L1 speaking and were automatically grouped in control group CEE.³⁵ The gender and age distributions can be seen in Table 4.1.

Participant demographics					
Group	Gender		Age		
	Male	Female	Group average	Male average	Female average
TAE	2	8	24	22	24.5
TEA	2	8	23.5	23.5	23.5
CAA	4	6	21.4	22.5	20.7
CEE	0	9	21.8	–	21.8
TOTAL	8	31	22.7	22.6	22.7

Table 4.1 The age and gender distribution of participants across the two test and two control groups.

Ethnicity

The majority of participants were white (92%). This was to be expected as most participants, those who were grouped in test groups TAE, TEA and control CAA, were required to be Afrikaans L1 speakers. The remaining 8% of participants were Indian (5%) and Coloured (3%) and were part of control group CEE although they did not constitute the entire group.

³⁵ Control group CEE referred to here is the same group discussed in Chapter 5. The English L1-speaking participants in control group CEE read and viewed the experimental materials once and the data was used in both Chapters 4 and 5 to compare to the English L2 reading of Afrikaans and Sesotho speakers.

Education

Participants all shared the basic educational level of Grade 12 schooling, but differed in their level of qualification and experience at university, ranging from first years to fourth years. Overall, 28 participants (72%) were undergraduate and 11 (28%) were postgraduate. They are therefore representative of different levels and capabilities of reading.

All participants were students who were enrolled for courses at the university at the time of data collection. The distribution across fields of study is as follows: Humanities and Behavioural Sciences, 24 participants (61.54%), Educational Sciences 8 participants (20.51%), and Economic Sciences 7 participants (17.95%). It may be argued that students from Humanities studying languages may have influenced the findings of the experiment – this was considered when signing up participants, but was not deemed a problem because these students are still representative of a part of the South African society that is currently viewing subtitled programming on public television.

When examining questionnaire questions on participants' parents' level of education, it is interesting to note that of all the participants, 44% of participants' fathers and 44% of their mothers had completed Grade 12, while a further 56% of mothers and fathers had completed tertiary education. This is relevant because it indicates that participants come from relatively educated households.

Vision

None of the participants wore prescription glasses, 3 wore contact lenses, and 36 had normal, uncorrected vision. The contact lenses had no effect on the data.

Due to a lack of variance in the demographical detail of participants, the abovementioned data was not used for statistical analyses. It is merely reported here to describe the participants.

4.3 PRIMARY DATA: READING SUBTITLES

All data was recorded automatically using BeGaze 2.5 and exported by means of Excel for further analysis in Statistica. The SMI iViewX™ system generates a vast amount of data, but for

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

the purpose of the current study, the focus was limited to five parameters of two kinds, namely count and duration measures. The five parameters that were studied include fixation count, glances count and revisitors count (count parameters) as well as dwell time total and fixation time total (duration parameters). These were all measured in terms of the areas of interest determined for this study, the subtitles. In the analysis of the collected data these parameters indicated two underlying phenomena – processing difficulty in the reading of the subtitles (absorption), as well as patterns for how the subtitles were read (vertical movements made between the subtitled area and the rest of the visuals above it). Evidence for differences in the processing of subtitles was therefore found in terms of two sets of findings. Firstly, longer fixation time total, longer dwell time total and more fixations indicated more difficulty in the reading and processing of the subtitles (absorption). Secondly, more glances and revisits indicated more interaction between the subtitled area and the visuals displayed above it (vertical movement).

Results were analysed in terms of the two halves of the film, the language of the respective halves and the number of lines in the subtitle. For the purpose of the discussion, the findings are organized based on the number of lines in the subtitle and are discussed accordingly.

4.3.1 Difference between the reading of 1-line and 2-line subtitles

Results are discussed in terms of one-line and two-line subtitles because of the well-documented differences between how they are read. To combine these two measures would add an additional, unknown variable to the results which one would not be able to account for.

Findings for the processing of one-line and two-line subtitles in the current experiment coincide with the findings of previous research on the topic. All groups spent proportionally more time reading two-line subtitles than one-line subtitles as was indicated by dwell time, fixation time, and fixation count, the three parameters used to measure absorption. This agrees with the findings of previous studies (Praet *et al.*, 1990; d'Ydewalle *et al.*, 1991; De Bruycker & d'Ydewalle, 2003; d'Ydewalle & De Bruycker, 2007). However, the overall values for time spent reading two-line and one-line subtitles separately and overall (one-line and two-line subtitles together) were considerably higher than that found in a comparable study by d'Ydewalle and De Bruycker in 2007.

Percentage time spent reading one-line and two-line subtitles		
	D'Ydewalle & De Bruycker (2007:200)	Current study (2011)
One-line	37 %	58 %
Two line	45 %	70 %
Overall	41 %	67 %

Table 4.2 Comparison of findings for overall time spent reading one-line and two-line subtitles. These values were calculated by considering dwell time as a percentage of the total visible time of the respective one-line and two-line subtitles, regardless of language.

The study conducted by d'Ydewalle and De Bruycker (2007) can be used as a comparative measure due to the similar natures of the experiments. Both experiments based the subtitle presentation on the six-second rule and in both cases the participants had no knowledge of the foreign language of the film (they showed a Swedish film with Dutch subtitles to Dutch participants), thus forcing them to read the subtitles. Participants were unbiased toward the purpose of both experiments and did not know they were going to read subtitles. In terms of the calculation for time spent in the subtitle, this value was calculated in both studies based on the total time spent in the subtitled area (fixations and saccades) as a percentage of the total visible time of the respective subtitles.³⁶

It should be noted at this point that there was one difference between the current study and that of d'Ydewalle and De Bruycker (2007) – the application of the six-second rule. d'Ydewalle and De Bruycker used a maximum of 32 characters per line, which corresponds to a reading speed of 11 characters per second (130 wpm), while the current study used a maximum of 37 characters per line, set at reading speed of 15 characters per second (180 wpm; cf. section 3.4.2). The implication of this difference is that a faster presentation rate and reading speed may have caused viewers to spend more time on the subtitles, meaning that the findings for the current study may have been lower had the subtitles been presented at a slightly slower speed. Information load needs to be discussed here briefly. According to the six-second rule, a full two-line subtitle should be displayed for six seconds. If a two-line subtitle is displayed for less than six seconds, this then means that the respective subtitle will place higher demands on the viewer's processing capacity as this subtitle would have to be read at a faster reading speed than was originally intended according to the rule. The six-second rule therefore serves as a guideline and is not necessarily always enforced with exact precision. In the current study, the six-second rule was

³⁶ This same method of calculation was not necessarily applied in all the other studies referred to here.

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

adhered to as closely as possible, with most subtitles being shorter than the full two lines and timed accordingly.

Upon analysis of the individual subtitles for the current study, the average presentation rate of one-line and two-line subtitles were found to be 140 and 175 wpm respectively for Afrikaans and English subtitles combined. The averages for Afrikaans subtitles were 144 and 175 wpm for one-line and two-line subtitles, while English subtitles were displayed at 135 and 175 wpm (cf. section 4.4.1.1).³⁷ Similar detailed values are not stated by d'Ydewalle and De Bruycker (2007) and thus there is no way of comparing the exact reading speeds of subtitles used in the two studies. The comparative values of the time spent in one-line and two-line subtitles (Table 4.2) can therefore only be considered as estimations, but should not be dismissed entirely.

De Brucker and d'Ydewalle (2003) reported the same values as d'Ydewalle and De Bruycker (2007), with 37% of time spent in one-line subtitles, 45% in two-line subtitles, and 41% overall. Praet *et al.* (1990) found slightly lower values – 23.93% for the reading of one-line subtitles and 37.41% for two-line subtitles. For subtitles presented to children in Grades 2, 4 and 6 according to the six-second rule, Koolstra *et al.* (1999:416) found that participants spent 36% of the presentation time reading one-line subtitles, 46% reading two-line subtitles, and 41% overall. d'Ydewalle *et al.* (1991) found that American participants spent 16.37% of the time in one-line and 21.87% in two-line subtitles, as opposed to Dutch participants who spent 16.09% and 24.39% reading one-line and two-line subtitles respectively. However, this experiment was slightly different in that it presented the two groups with different films, both with same-language (intralingual) subtitles.³⁸ The abovementioned studies also used a maximum of 32 characters per line for their application of the six-second rule.

Nevertheless, the high values found for the current study are slightly worrisome, as participants spent most of their time reading the subtitles and hardly had time to look at the rest of the screen.

³⁷ These values were calculated by dividing the number of words in the individual subtitles by the visible time of the respective subtitles and calculating the averages. For these calculations, the average word in Afrikaans was taken to consist of 4.8 characters, while the average English word was taken to consist of 4.7 characters. This was based on corpus analyses of the BNC (British National Corpus) and the ATK (Afrikaanse Taalkommissie Korpus or “Afrikaans Language Commission Corpus”).

³⁸ What is interesting about this finding is that the Dutch participants from Belgium, who are generally thought to read more subtitles on a day-to-day basis, spent more time reading two-line subtitles than the American participants, which raises the question as to whether one can ever ‘get used to’ reading subtitles.

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

This is not the ideal for the presentation of subtitles – subtitles are not supposed to detract from the overall viewing of a programme. One possible explanation for the difference in values for d’Ydewalle and De Bruycker (2007) and the current study is that, in their case, the subtitles were shown to Dutch participants, who are generally more exposed to the reading of subtitles. However, assumptions about the effect of participants’ familiarity with subtitles should be made with caution as there are different perceptions as to what these effects are and how they are to be measured.³⁹ What is even more worrisome is that, in the case of Koolstra *et al.* (1999), the values were measured for children in primary school whereas in the current study they were measured for university students – the university students spent more time reading the subtitles. Values were also high when examining the difference for Afrikaans and English subtitles, as can be seen in Table 4.3. In both cases (separate for one-line and two-line subtitles as well as combined) more time was spent reading Afrikaans subtitles.

Percentage time spent reading Afrikaans and English one-line and two-line subtitles			
	Afrikaans subtitles	English subtitles read by L1 speakers	English subtitles read by L2 speakers
One-line	62 %	51 %	56 %
Two line	71 %	66 %	72 %
Overall	68 %	62 %	67 %

Table 4.3 Comparison of findings for time spent reading Afrikaans and English one-line and two-line subtitles. These values were calculated by considering dwell time as a percentage of the total visible time of the one-line and two-line subtitles per language group.

In order to calculate the different groups’ allocation of attention, three measures were used: the total visible time of the subtitles as a percentage of the duration of the video (starting when the first subtitle appeared and the last subtitle disappeared), the total dwell time of participants within the areas of interest (the subtitles) as a percentage of the duration of the video (starting when the first subtitle appeared and the last subtitle disappeared), and participants’ dwell time within the areas of interest as a percentage of the visible time of the subtitles. These values can be seen in Table 4.4 below.

³⁹ See also the comments in the footnotes to section 6.3.3 of the current study on the matter of familiarity.

Percentage time spent reading subtitles in terms of film duration						
Group	VT of subtitles [sec.]	Film duration - subtitles only [sec.]	VT as % of total film duration - subtitles only	DT in subtitles [sec.]	DT as % of total film duration - subtitles only	DT as % of VT
CAA	2052.4	2906.0	70.6	1403.9	48.3	68.4
TAE	2013.2	2906.0	69.3	1384.1	47.6	68.8
TEA	2035.2	2906.0	70.0	1358.7	46.8	66.8
CEE	1796.7	2615.4	68.7	1113.0	42.6	61.9

Table 4.4 Calculation of the time spent reading subtitles based on the visible time (VT) of the subtitles and participants' dwell time (DT) in the subtitles, using the duration of the film (starting when the first subtitle appeared and ending when the last subtitle disappeared).

In terms of vertical movement and interaction between the subtitled area at the bottom of the screen and the rest of the visuals above it, the most significant finding was that the English L1-speaking participants generally made significantly more vertical movements in the form of glances and revisits than did the Afrikaans L1-speaking participants.⁴⁰ This was found for both one-line and two-line subtitles for the duration of the film, although the differences in the first half of the film were much bigger and more significant than those in the second half of the film.⁴¹ In this regard, the difference in reading cannot be ascribed to English L1 versus English L2 reading but rather to the L1 of the respective participants, in other words Afrikaans or English.

The findings for vertical movement cannot be compared to previous studies in detail, as no other study measured the difference between the reading of two different subtitled languages when the soundtrack was in a foreign language and not the same as either of the two subtitled languages. The studies that are comparable to some extent (De Bruycker & d'Ydewalle, 2003; d'Ydewalle & De Bruycker, 2007) measured the difference in reading standard (interlingual – foreign language soundtrack, native language subtitles) and reversed (native language soundtrack, foreign language subtitles) subtitling. Both found more vertical movements for standard (0.49) than reversed (0.24) subtitles, which one might interpret as meaning that, if the subtitled language is understood and read for comprehension, more vertical movements will be made than if the language to be read is not understood, but this cannot be said with absolute certainty.

⁴⁰ As was mentioned in Chapter 3, both glances and revisits relate to a subtitle being visited and then revisited by making subsequent glances back to the subtitled area after having visited it for the first time.

⁴¹ In one instance (one-line subtitles, second half) the Afrikaans L1-speaking participants in test group TAE made a few more glances ($M = 1.56$) than the English L1-speaking participants in CEE ($M = 1.53$) but the difference was insignificant.

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

As is discussed in the sections to follow, no significant differences were found in the reading of Afrikaans subtitles. The only significant differences were found in the reading of English subtitles as read by Afrikaans L1-speaking participants (TEA, TAE) and English L1-speaking participants (CEE). The most significant differences were found for test group TAE in terms of the processing of English L2 subtitles during the second half of the film.

4.3.2 One-line subtitles

One-line subtitles were analysed in terms of absorption and vertical movement based on the language and the two halves of the film.

4.3.2.1 Absorption

In terms of absorption it was found that the Afrikaans L1 speakers in the test and control groups read Afrikaans one-line subtitles almost the same for the duration of the film. There were no statistically significant differences in the means, in other words participants in both the test and control groups processed the Afrikaans one-line subtitles with the same ease. This was indicated by dwell time total, fixation time total and fixation count. For English subtitles the results differ slightly. During the first half of the film there were no statistically significant differences in the means of Afrikaans L1 speakers and English L1 speakers reading English one-line subtitles. During the second half, however, the Afrikaans L1 speakers (TAE) needed more time to process the English subtitles than their English L1-speaking counterparts (CEE). It was also found that the Afrikaans L1 speakers generally spent more time reading the subtitles than the English L1 speakers, regardless of whether the subtitles they were reading were Afrikaans or English.

One-line subtitles: First half								
Cond	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		Means	Std.Dev.	Means	Std.Dev.	Means	Std.Dev.	
C	A	1733.590	576.811	1508.061	525.071	7.669	2.036	130
C	E	1468.238	468.940	1272.838	423.255	6.533	1.861	90
T	A	1674.135	545.233	1473.455	513.303	7.023	1.931	130
T	E	1437.141	553.869	1252.254	498.638	6.430	2.124	100

Table 4.5 Means and standard deviations of the parameters indicating the processing difficulty (absorption) of one-line subtitles during the first half of the film.

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

One-line subtitles: Second half								
Cond	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		Means	Std.Dev.	Means	Std.Dev.	Means	Std.Dev.	
C	A	1490.835	623.192	1311.259	557.293	6.400	2.267	130
C	E	1222.057	451.082	1056.799	413.703	5.500	1.664	90
T	A	1485.806	575.053	1297.935	523.474	6.538	2.189	130
T	E	1539.356	543.363	1360.785	506.216	6.570	1.955	100

Table 4.6 Means and standard deviations of the parameters indicating the processing difficulty (absorption) of one-line subtitles during the second half of the film.

Dwell time total

In the first half of the film there was no significant interaction between the groups, language or condition in terms of dwell time ($F(1, 446)=0.07490$, $p>0.05$). In other words, Afrikaans and English subtitles were read similarly by the respective groups – all participants processed the subtitles with similar ease.

In the second half there was significant interaction between language and condition for dwell time ($F(1, 446)=9.0628$, $p<0.05$) in the sense that the English test and control groups showed an obvious difference in reading. However, no difference was found for the reading of Afrikaans subtitles by the Afrikaans test and control groups. For the reading of English subtitles, the difference in the means for dwell time of test group TAE ($M = 1539.356$ ms, $SD = 543.363$) and control group CEE ($M = 1222.057$ ms, $SD = 451.082$) was 317 ms ($t = -4.35$, $p<0.01$) and had a medium effect size ($d = 0,58$). On average, the Afrikaans L1 speakers therefore took 317 ms longer to read the subtitles in their L2, English, than did the English L1 speakers who read the subtitles in their L1. Overall there were no statistically significant differences in the reading of Afrikaans one-line subtitles, only for English.

Fixation time total

In the first half of the film there was no significant interaction for fixation time ($F(1, 446)=0.02182$, $p>0.05$). As with dwell time, this indicates that participants in the various groups processed the subtitles similarly.

In the second half of the film significant interaction was found between language and condition for fixation time ($F(1, 446)=10.606$, $p<0.05$), again based on the large difference in the reading

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

of English one-line subtitles by the test and control groups; no difference was found in the reading of Afrikaans subtitles. The difference in the reading of English subtitles is evident from the difference in the means for fixation time of test group TAE ($M = 1360.785$ ms, $SD = 506.216$) and control group CEE ($M = 1056.799$ ms, $SD = 413.7032$). This difference of 304 ms ($t = -4.50$, $p < 0.01$) had a medium effect size ($d = 0,6$) in terms of Cohen's practical significance. The fixations made by the Afrikaans L1 speakers were therefore 304 ms longer on average when reading the subtitles in their L2, English, than was the case for the English L1 speakers reading in their L1. As was found for dwell time total, there were no statistically significant differences in the reading of Afrikaans one-line subtitles overall, only for English.

Fixation count

There was no statistically significant interaction in the first half of the film in terms of fixation count ($F(1, 446) = 2.0337$, $p > 0.05$), which indicates that Afrikaans and English subtitles were processed with similar ease by participants in the respective groups. This corresponds to the findings for both dwell time and fixation time.

In the second half, however, there was a statistically significant interaction between language and condition ($F(1, 446) = 5.5623$, $p < 0.05$), again based on the large differences in the reading of English subtitles only, not for Afrikaans. The English subtitles were read differently by TAE ($M = 6.57$, $SD = 1.955$) and CEE ($M = 5.5$, $SD = 1.664$), with a difference of 1.07 in the means of fixation count ($t = -4.04$, $p < 0.01$). This difference had a medium effect size of ($d = 0,55$). The Afrikaans L1 speakers therefore made 1.07 more fixations when reading subtitles in their L2, English, than did the English L1 speakers when reading the subtitles in their L1.

All three parameters used to measure absorption therefore indicate that test group TAE, who read English L2 subtitles during the second half of the film, needed more time to process the English one-line subtitles. This was proven through statistical significance with medium effect sizes for all three parameters. No other significant differences were detected.

4.3.2.2 Vertical movement

There were no statistically significant differences in the means of glances and revisitors counts for the Afrikaans L1 speakers in the test and control groups reading one-line subtitles. All the

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

Afrikaans L1 participants therefore read the same in terms of the vertical movements made between the subtitled area and the rest of the screen. Furthermore, it was found that the Afrikaans speakers in general made fewer jumps between the subtitled area and the rest of the visuals on the screen than the English L1 speakers when reading one-line subtitles.

In the first half of the film, the Afrikaans L1-speaking participants in groups TAE, CAA and TEA displayed similar reading patterns with glances and revisitors count values almost the same, regardless of whether they read English or Afrikaans subtitles. Control group CEE stood out, having made considerably more vertical movements than all the rest. In the first half of the film there was therefore a large difference in L2 and L1 reading of English subtitles – test group TEA made considerably fewer vertical movements than CEE when reading the English subtitles. This changed in the second half of the film – the Afrikaans L1 speakers in groups TEA and CAA still displayed similar reading patterns for Afrikaans subtitles, but TAE, who now read English L2 subtitles, displayed significantly more vertical movement for the English subtitles. The number of vertical jumps made by TAE was now closer to the pattern of their English L1-speaking counterparts. This was unexpected because TAE was found to differ significantly from CEE in terms of the amount of time needed to process the English subtitles (absorption).

One-line subtitles											
		First half					Second half				
Cond	Lang	Glances count		Revisitors count		N	Glances count		Revisitors count		N
		Means	Std.Dev.	Means	Std.Dev.		Means	Std.Dev.	Means	Std.Dev.	
C	A	1.22	0.45	0.21	0.41	130	1.37	0.54	0.34	0.48	130
C	E	1.61	0.65	0.53	0.50	90	1.53	0.62	0.47	0.50	90
T	A	1.32	0.56	0.29	0.46	130	1.31	0.50	0.31	0.46	130
T	E	1.28	0.55	0.27	0.45	100	1.56	0.70	0.44	0.50	100

Table 4.7 Means and standard deviations of the parameters indicating the vertical movements made when reading one-line subtitles for the first and second halves of the film.

Glances count

In the first half of the film, the interaction between language and condition was significant ($F(1, 446)=16.332, p<0.05$), such that for English subtitles the test and control groups differed, but the Afrikaans test and control groups were quite similar in terms of the number of glances made to the subtitles. For the reading of English one-line subtitles, the difference in the means for CEE ($M = 1.611, SD = 0.648$) and TEA ($M = 1.28, SD = 0.552$) was 0.331 ($t = 3.80, p<0.01$) and had a medium effect ($d = 0,51$) in terms of Cohen’s scale of practical significance. The English L1-

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

speaking participants in control group CEE therefore made 0.331 more glances than English L2-speaking participants in test group TEA, a significant difference in terms of the scale of values.

In the second half, the interaction between language and condition was non-significant ($F(1, 446)=0.62139, p>0.05$) – both Afrikaans and English subtitles were read similarly by the respective groups. The interesting thing here is that test group TAE showed an increase in the number of glances made from the first half of the film ($M = 1.315, SD = 0.557$) to the second ($M = 1.56, SD = 0.701$), which now closely resembled the number of glances made by control group CEE ($M = 1.533, SD = 0.622$). The difference between the glances count means of CEE and TAE for the reading of English one-line subtitles in the second half of the film was a mere 0.03. The lack of obvious differences in the reading of one-line subtitles in second half of the film indicate that participants reading Afrikaans and English subtitles in their respective groups read the same in terms of their interaction with the subtitles and the rest of the visuals.

Revisitors count

A significant interaction was found between language and condition for revisitors count ($F(1, 446)=16.367, p<0.05$) in the first half of the film, again showing difference for the English test and control groups but not for Afrikaans. The difference in the revisitors count for the reading of English subtitles was found between control group CEE ($M = 0.533, SD = 0.502$) who read the subtitles in their L1 and test group TEA ($M = 0.27, SD = 0.446$) who read the subtitles in their L2. This difference of 0.263 ($t = 3.83, p<0.01$) had a medium effect size ($d = 0,52$).

The second half showed no significant interactions ($F(1, 446)=0.00198, p>0.05$). As with glances count, this indicates that participants reading Afrikaans and English subtitles respectively read the same in terms of their interaction with the subtitles and the rest of the visuals.

Both parameters used to measure vertical movement indicate that test group TEA, who read English L2 subtitles during the first half of the film, made much fewer vertical movements during their reading of one-line subtitles than did control group CEE. Yet test group TAE, who read English L2 subtitles during the second half of the film, displayed reading patterns similar to those of control group CEE in terms of vertical movement. There were no statistically significant findings for the reading of Afrikaans one-line subtitles. In general, the Afrikaans L1 speakers

made fewer vertical movements than the English L1 speakers. No other significant differences were found.

4.3.3 Two-line subtitles

Two-line subtitles were analysed in terms of absorption and vertical movement based on the language and the two halves of the film.

4.3.3.1 Absorption

As was found for one-line subtitles, dwell time total and fixation time total indicated that, overall, the Afrikaans L1 speakers in the test and control groups read Afrikaans two-line subtitles almost the same for the duration of the film, in other words participants processed the Afrikaans two-line subtitles with the same ease. There were no statistically significant findings for the reading of Afrikaans subtitles. For English, however, it was found that the Afrikaans L1 speakers spent significantly more time reading the English two-line subtitles in the second half than the English L1 speakers, whereas in the first half they read the subtitles with similar ease. Significance therefore lay in the second half of the film. More general findings include that more time was spent reading two-line than one-line subtitles for both Afrikaans and English subtitles, and that the Afrikaans L1 speakers generally spent more time reading two-line subtitles than their English L1-speaking counterparts.

Two-line subtitles: First half								
Cond	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		Means	Std.Dev.	Means	Std.Dev.	Means	Std.Dev.	
C	A	2737.074	875.791	2341.941	784.329	11.869	3.312	160
C	E	2568.123	811.411	2184.359	715.957	11.043	3.316	162
T	A	2744.794	751.639	2362.596	699.730	11.575	2.769	160
T	E	2678.929	859.736	2295.953	790.294	11.478	3.160	180

Table 4.8 Means and standard deviations of the parameters indicating the processing difficulty (absorption) of two-line subtitles during the first half of the film.

Two-line subtitles: Second half								
Cond	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		Means	Std.Dev.	Means	Std.Dev.	Means	Std.Dev.	
C	A	2733.854	920.223	2345.048	821.100	11.655	3.459	200
C	E	2527.088	727.389	2126.716	670.690	11.228	3.004	180
T	A	2698.224	887.689	2309.207	801.353	11.645	3.477	200
T	E	2867.148	776.293	2473.642	718.332	12.075	3.014	200

Table 4.9 Means and standard deviations of the parameters indicating the processing difficulty (absorption) of two-line subtitles during the second half of the film.

Dwell time total

In the first half of the film there was no significant interaction between the groups, language or condition in terms of dwell time for two-line subtitles ($F(1, 658)=0.64122, p>0.05$). This means that Afrikaans and English subtitles were read similarly by the respective groups – all participants processed the two-line subtitles with similar ease.

However, statistically significant interaction was found in the second half of the film between language and condition for dwell time ($F(1, 776)=9.8680, p<0.05$) – the English test and control groups displayed obvious differences in reading, whereas the Afrikaans test and control groups did not; they read the subtitles quite the same. Participants reading English in the second half of the film displayed an average difference of 340.06 ms in the means for dwell time [TAE ($M = 2867.148$ ms, $SD = 776.293$); CEE ($M = 2527.088$ ms, $SD = 727.389$); $t = -4.39, p<0.01$]. In terms of Cohen’s practical significance, this difference had a medium effect size ($d = 0,44$). This means that the Afrikaans L1 speakers spent 340.06 ms longer reading two-line subtitles in their L2, English, than did the English L1-speaking participants who read the subtitles in their L1. Overall there were no statistically significant differences in the reading of Afrikaans two-line subtitles, only for English.

Fixation time total

The first half of the film displayed no statistically significant interaction for fixation time ($F(1, 658)=0.60704, p>0.05$). As with dwell time, this means that the two-line subtitles were processed with the same ease during the first half of the film.

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

In the second half there was a significant interaction between language and condition for fixation time ($F(1, 776)=12.425$, $p<0.05$). This was once again based on the large differences in the reading of English subtitles by the test and control groups; no difference was found in the reading of Afrikaans subtitles. The difference in the reading of English subtitles in terms of fixations were found for test group TAE ($M = 2473.642$ ms, $SD = 718.332$) and control group CEE ($M = 2126.716$ ms, $SD = 670.690$). The difference of 346.93 ($t = -4.85$, $p<0.01$) ms had a medium effect size ($d = 0,48$) in terms of practical significance. This means that the fixations made by the Afrikaans L1 speakers were 346.93 ms longer on average when reading the subtitles in their L2, English, than was the case for the English L1 speakers reading L1 subtitles. As was found for dwell time, there were no statistically significant differences in the reading of Afrikaans two-line subtitles, only for English.

Fixation count

There was no statistically significant interaction in the first half of the film in terms of fixation count ($F(1, 658)=2.2092$, $p>0.05$), which indicates that Afrikaans and English two-line subtitles were processed with similar ease by participants in the respective groups. This corresponds to the findings for both dwell time and fixation time.

There was no statistically significant interaction in terms of fixation count in the second half of the film either ($F(1, 776)=3.3787$, $p>0.05$). However, there was some difference in the means of the fixation count for TAE ($M = 12.075$, $SD = 3.014$) and CEE ($M = 11.228$, $SD = 3.004$) who read English subtitles in the second half of the film. TAE therefore made 0.847 ($t = -2.74$, $p<0.01$) more fixations than CEE. The fact that TAE made more fixations than CEE correlates with the findings for dwell time total and fixation time total in that participants in TAE needed more time to process the English subtitles in the second half of the film than did the English L1-speaking participants (CEE). Once again there were no statistically significant differences in the reading of Afrikaans two-line subtitles, only for English.

Two of the three parameters used to measure absorption therefore indicate by means of statistical significance that test group TAE, who read English L2 subtitles during the second half of the film, experienced difficulty in processing the English two-line subtitles. This was proven through statistical significance with medium effect sizes for both these parameters (dwell time total and

fixation time total). This correlates with the findings for one-line subtitles. No other significant differences were detected.

4.3.3.2 Vertical movement

The findings for two-line subtitles in terms of vertical movements made between the subtitled area and the rest of the visuals on-screen strongly correspond to the findings for one-line subtitles. No statistically significant differences were found for glance and revisitors counts for Afrikaans L1 speakers reading two-line subtitles, meaning that all the Afrikaans L1 participants read two-line subtitles the same in terms of the vertical movements made between the subtitled area and the rest of the screen. In general it was found that the Afrikaans L1 speakers made fewer jumps between the subtitled area and the rest of the visuals on the screen than the English L1 speakers when reading two-line subtitles.

As was the case for one-line subtitles, the Afrikaans L1-speaking participants in groups TAE, CAA and TEA displayed similar reading patterns in the first half of the film, with glances and revisitors count values being almost the same regardless of whether they read English or Afrikaans subtitles. Control group CEE stood out, having made considerably more vertical movements than all the rest. In the first half of the film there was therefore a large difference in L2 and L1 reading of English subtitles – test group TEA made considerably fewer vertical movements than CEE when reading the English two-line subtitles. This changed in the second half of the film – the Afrikaans L1 speakers in groups TEA and CAA still displayed similar reading patterns for Afrikaans subtitles, but TAE, who now read subtitles in their L2, English, displayed considerably more vertical movement for the English subtitles. The number of vertical jumps made by TAE was now closer to the pattern of their English L1-speaking counterparts.

Two-line subtitles											
		First half					Second half				
Cond	Lang	Glances count		Revisitors count		N	Glances count		Revisitors count		N
		Means	Std.Dev.	Means	Std.Dev.		Means	Std.Dev.	Means	Std.Dev.	
C	A	1.43	0.61	0.37	0.48	160	1.38	0.57	0.34	0.47	200
C	E	1.65	0.71	0.54	0.50	162	1.62	0.78	0.48	0.50	180
T	A	1.45	0.62	0.39	0.49	160	1.32	0.60	0.28	0.45	200
T	E	1.36	0.56	0.32	0.47	180	1.49	0.69	0.40	0.49	200

Table 4.10 Means and standard deviations of the parameters indicating the vertical movements made when reading two-line subtitles for the first and second halves of the film.

Glances count

As was the case for one-line subtitles, the interaction between language and condition in the first half of the film was significant ($F(1, 658)=11.095, p<0.05$) – for English subtitles the test and control groups differed, but the Afrikaans test and control groups were quite similar in terms of the number of glances made to the subtitles. For the reading of English two-line subtitles, the difference in the means for control group CEE ($M = 1.654, SD = 0.708$) and test group TEA ($M = 1.356, SD = 0.556$) was 0.298 ($t = 4.36, p<0.01$) and had a medium effect ($d = 0,42$) in terms of Cohen's scale of practical significance. The English L1-speaking participants in control group CEE therefore made 0.331 more glances than English L2-speaking participants in test group TEA, a significant difference in terms of the scale of values.

In the second half, the interaction between language and condition was non-significant ($F(1, 776)=0.58098, p>0.05$) – both Afrikaans and English subtitles were read similarly by the respective groups. This lack of significant differences in the reading of two-line subtitles in the second half of the film indicates that participants reading Afrikaans and English subtitles respectively read the same in terms of their interaction with the subtitles and the rest of the visuals. Test group TAE again showed an increase in the number of glances made from the first half of the film ($M = 1.45, SD = 0.622$) to the second ($M = 1.49, SD = 0.687$), but not as great as for one-line subtitles. Also different from the findings for one-line subtitles was that the other two groups with Afrikaans L1-speaking participants (TEA and CAA) showed a decrease in the number of glances made for two-line subtitles from the first half of the film to the second.

Revisitors count

As for one-line subtitles, a significant interaction was found between language and condition for revisitors count ($F(1, 658)=10.054, p<0.05$) in the first half of the film, showing a difference for the English test and control groups but not for Afrikaans. For the groups that read English during the first half of the film, the difference lay in the reading of L1 subtitles by control group CEE ($M = 0.537, SD = 0.500$) and the reading of L2 subtitles by test group TEA ($M = 0.317, SD = 0.466$). This difference of 0.22 ($t = 4.22, p<0.01$) had a medium effect size ($d = 0,44$).

The second half showed no significant interactions ($F(1, 776)=0.06699, p>0.05$). As with glances count, this indicates that participants reading Afrikaans and English subtitles

respectively read the same in terms of their interaction with the subtitles and the rest of the visuals. As was found for glances count, the two groups with Afrikaans L1-speaking participants who read Afrikaans subtitles in the second half of the film (TEA and CAA) showed a decrease in the number of revisits made to two-line subtitles from the first half to the second.

Both parameters used to measure vertical movement indicate that test group TEA, who read English subtitles during the first half of the film, made much fewer vertical movements during their reading of two-line subtitles than did control group CEE. There were no statistically significant findings for the reading of Afrikaans one-line subtitles. In general, the Afrikaans L1 speakers made fewer vertical movements than the English L1 speakers. No other significant differences were found.

4.3.4 Conclusion

Participants in all groups were found to spend proportionally more time reading two-line than one-line subtitles – of the total amount of time that one-line and two-line subtitles were visible respectively, participants spent 70% of the time reading two-line subtitles and 58% of the time reading one-line subtitles (cf. Tables 4.2 and 4.3). This agrees with the findings of previous studies (Praet *et al.*, 1990; d’Ydewalle *et al.*, 1991; De Bruycker & d’Ydewalle, 2003; d’Ydewalle & De Bruycker, 2007), although the values found in the current study were considerably higher. In terms of processing (absorption), the Afrikaans L1-speaking participants in both the test groups (TEA, TAE) and the control group (CAA) spent more time overall reading the two-line subtitles than the English L1-speaking participants in control group CEE. In the case of TAE where Afrikaans L1-speaking participants read English L2 subtitles in the second half of the film, these findings were even more conclusive – the Afrikaans L1-speaking participants spent significantly more time reading the English subtitles than did the English participants (CEE). This was the found for both one-line and two-line subtitles. English subtitles were therefore processed with more ease by native speakers than non-native speakers during the second half of the film.

In terms of vertical movement, the number of glances and revisits made by Afrikaans L1-speaking participants who read English L2 subtitles during the first half of the film (TEA) agreed with those of the other Afrikaans participants and was considerably less than the number of glances and revisits made by the English L1-speaking participants (CEE). This was found for

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

both one-line and two-line subtitles. In the second half, the number of glances and revisits made by TEA stayed almost the same even though the language of the subtitles changed, keeping in agreement with the overall subtitle reading pattern of the Afrikaans L1 speakers. However, when the switch in language was the other way around (from Afrikaans to English) for test group TAE, the reading pattern for the second half English subtitles changed considerably and no longer resembled that of the rest of the Afrikaans L1 speakers. Instead, it now resembled the reading pattern of the English L1 speakers in control group CEE in terms of the number of vertical movements made and the extent to which interaction occurred between the subtitled area and the rest of the screen. This was found for both one-line and two-line subtitles. If one draws the assumption from the findings of d'Ydewalle and De Brucker (2007) (cf. section 4.3.1) that a better reading and understanding of subtitles coincides with more vertical movements between the subtitled area and the visuals above it, the patterns found for the reading of Afrikaans and English subtitles in the current study (more vertical movement for English than Afrikaans subtitles in general) means that participants read and understood the English subtitles better than the Afrikaans subtitles. However, from what was found in terms of processing, this cannot be true for the test groups, especially test group TAE. Because much more is documented about the interpretation of the amount of time people spend reading the subtitles and how it relates to processing demands, and because not much is known about the relevance of vertical movement in this regard, the assumption drawn from d'Ydewalle and De Bruycker (2007) is not supported or further elaborated on in the current study.

In conclusion, test group TAE was the only group to display significant differences in reading behaviour. This was found mainly for the absorption of English subtitles as L2 text when compared to control group CEE who read the English subtitles in their L1. These differences might be attributed to the L2 reading of English subtitles, but this cannot be said without considering possible confounding variables. As the purpose of the current study was to measure the difference in the processing of L1 and L2 subtitles, the remainder of the results are discussed in terms of the absorption parameters that indicate processing ease or difficulty only. More specifically, the discussion of further results focuses on the findings for dwell time total and fixation time total measured in milliseconds. Because vertical movement does not relate directly to measures of processing demand and very little is known and/or documented about such a relation, vertical movement is excluded from further in-depth discussions to follow.

4.4 SECONDARY DATA: CONFOUNDING VARIABLES

Given the fact that the differences between L1 and L2 English subtitle reading were not consistent across both halves of the film and that the L1-L2 correspondence was different for absorption than for vertical movement, it is necessary to explore possible alternative explanations for the observed L2 subtitle reading efforts. In order to do so, possible confounding variables were analysed, namely participants' reading speeds for static text and their corresponding levels of comprehension, the length of the subtitles (word and character count), participant demographics, participants' television and film viewing habits, and participants' attitude toward reading subtitles. Correlations were performed in order to find significant interactions. The results of the correlations between these variables and the eye-tracking data for the reading of subtitles are discussed in the sections to follow.

As was mentioned in Chapter 3, each of these variables was evaluated against three criteria to see if it could explain the differences found in subtitle reading: statistically significant effect, linear relation and participant distribution. The variables passed the first two criteria to a varying extent. However, in the end none passed all three criteria to support an alternative hypothesis that the differences observed for subtitle reading could be attributed to a factor other than L1 and L2 reading.

4.4.1 Reading speed for static text

As explained in the previous chapter, participants were given static text to read which was accompanied by a multiple-choice comprehension test. The main interest in gathering this data was the consideration of reading speed and comprehension as possible confounding variables. Furthermore, because participants read the text before watching the subtitled film, they familiarized themselves with the equipment.

For the test groups there are two sets of values, one for Afrikaans reading speed and comprehension, and one for English reading speed and comprehension, while the control groups have only one set each for either Afrikaans or English. Table 4.11 contains the values per participant as well as per group. When considering the reading speeds overall, the groups can be ranked as follows:

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

- (1) TAE (Afrikaans) = 227 wpm
- (2) TAE (English) = 201.2 wpm
- (3) CAA (Afrikaans) = 191.6 wpm
- (4) TEA (Afrikaans) = 187.3 wpm
- (5) CEE (English) = 182.9 wpm
- (6) TEA (English) = 170.9 wpm

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

Reading speed and comprehension scores				
	Afrikaans		English	
Case	Reading speed [wpm]	Comprehension test score %	Reading speed [wpm]	Comprehension test score %
TAE 1	196	75	162	60
TAE 3	176	63	164	60
TAE 5	184	75	164	60
TAE 6	137	75	112	70
TAE 7	290	75	305	40
TAE 8	290	88	242	60
TAE 9	328	75	283	70
TAE 10	240	100	209	70
TAE 11	179	88	152	80
TAE 12	250	75	219	30
Average TAE	227	78.9	201.2	60
TEA 1	141	88	123	40
TEA 2	157	63	164	30
TEA 3	187	75	150	70
TEA 4	193	75	197	70
TEA 5	219	63	197	30
TEA 6	218	100	224	60
TEA 7	167	75	139	60
TEA 8	142	75	145	60
TEA 9	230	75	170	40
TEA 10	219	63	200	70
Average TEA	187.3	75.2	170.9	53
CAA 2	128	63	–	–
CAA 3	298	75	–	–
CAA 7	111	63	–	–
CAA 9	214	63	–	–
CAA 10	184	75	–	–
CAA 11	238	50	–	–
CAA 12	121	100	–	–
CAA 13	267	75	–	–
CAA 14	143	63	–	–
CAA 15	212	75	–	–
Average CAA	191.6	70.2	–	–
CEE 1	–	–	206	40
CEE 2	–	–	151	80
CEE 3	–	–	141	60
CEE 4	–	–	151	40
CEE 5	–	–	171	60
CEE 6	–	–	184	60
CEE 7	–	–	250	70
CEE 8	–	–	216	80
CEE 9	–	–	176	50
Average CEE	–	–	182.9	60.0

Table 4.11 Results for the reading of static text and comprehension test(s). Reading speed was measured as words per minute (wpm) and the scores for the comprehension tests were calculated as a percentage mark.

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

Chapter 3 stated that students, after having completed the Reading Laboratory programme, should be able to read at a reading speed of 420 wpm at 80% comprehension (cf. section 3.4.1). Although participants were instructed to read at their own pace for the current study, they are clearly reading below the expected level. However, data on reading speed and comprehension should be interpreted with some care – in assessing the numeric values obtained from investigations, one has to be careful about the benchmarks against which performance is assessed. Nel *et al.* (2004) used a benchmark of 280 wpm as basis for their assessment. This is relatively close to the benchmark of 300 wpm which Carver (1990, 1992) proposed, based on a very comprehensive theory of different factors influencing reading rate. However, Carver specifically proposed this value for the third of five so-called gears of reading, termed ‘rauding’, the most comfortable rate for comprehension and eye-movements. Carver (1992:85) contrasted the third gear to the second gear which he termed the learning process. The reading rate in second gear is about 200 wpm, and is employed when the reader knows that he/she will be held accountable for their comprehension, for example by being asked questions on the content. This, in turn, is quicker than the first gear, memorising, which is characterised by a reading rate of about 138 wpm. Based on the instructions given in the current study, participants were likely to have read in the so-called second gear, which might explain the slightly lower than expected reading rates.

Nevertheless, when considering overall reading achievement, it is generally recognized that students’ reading capabilities are not what they ought to be, and not only at the campus where the current study was conducted. Pretorius (2000:36) found that more than fifty percent of the 1200 Psychology and Sociology undergraduate students studying at the University of South Africa (Unisa) who’s reading ability were tested read at a comprehension level of 50% or lower. Furthermore, a small sample of these students were found to read at a reading speed of 96 wpm, which according to Pretorius was “far below the recommended minimum of at least 150 wpm for L2 readers” (*ibid.*). Comparative data gathered from the Reading Laboratory of the Potchefstroom campus of the North-West University found that the reading skills of first-year students have decreased dramatically over the past few years, as can be seen in Table 4.12.

Year	Reading speed [wpm]	Comprehension [%]	Grade level
2001	210	67	Gr 8/9
2002	222	70	Gr10
2003	249	69	Gr 12
2004	214	76	Gr 9
2005	221	76	Gr 10
2006	230	73	Gr10/11
2007	199	68	Gr 7/8
2008	214	74	Gr9
2009	218	58	Gr 9/10
2010	180	50	Gr 5/6

Table 4.12 Comparative data of the reading skills of first-year students enrolled at the Potchefstroom campus of the North-West University (NWU, 2010c).

The grade level is the grade corresponding to the level of reading measured for the students. In other words, in 2010 first-year students entering the university were found to read at the level of Grade 5 or 6 pupils. When compared to this data, the reading speeds of participants in the current study are average and almost expected. However, not all participants in the current study were first-year students, flagging the low reading speeds as a source of concern.

4.4.1.1 Correlation between reading speed and subtitle reading

The relation between reading speed for static text and subtitle reading was analysed for three purposes – to find the correlation(s) between reading speed and subtitle processing (absorption), reading speed and vertical movement, and reading speed for static text and reading speed for subtitles. The correlation between reading speed and subtitle processing was the primary concern and was the only one evaluated against the three criteria to see if it could explain the differences found in subtitle reading. In other words, the following three questions had to be asked:

- Did it have a significant effect on subtitle reading?
- If so, was the effect linear and in the hypothesized direction? (i.e. did it hold an advantage for subtitle reading?)
- If so, did it agree with the distribution pattern found for the observed difference in subtitle reading? (i.e. did the findings for static text reading agree with the findings for subtitle reading?)

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

All three these conditions had to be satisfied in order for reading speed to explain the differences found for subtitle reading.

Absorption

Overall, a negative correlation was found when comparing the reading speed for static text with the processing (absorption) of subtitles. In other words, the faster a participant read the static text in terms of words per minute, the less time was spent in the subtitled area – when assessing reading speed for static text reading (measured in words per minute) higher values are better, indicating faster reading; when assessing subtitle reading (measured in terms of the amount of time spent reading the subtitles) lower values are better, indicating faster reading. A negative correlation is therefore expected and was found for dwell time total, fixation time total and fixation count. The correlations were statistically significant, and as the findings were expected, they measured in the hypothesized direction.

Correlations: Reading speed vs. Absorption parameters								
Group	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		r	p	r	p	r	p	
CAA	A	-0.3967	0.000	-0.4406	0.000	-0.2894	0.000	620
TAE & TEA	A	-0.1769	0.000	-0.2052	0.000	-0.1112	0.006	620
CEE	E	-0.1468	0.001	-0.1876	0.000	-0.1236	0.005	522
TAE & TEA	E	-0.1018	0.014	-0.1345	0.001	-0.0250	0.548	580

Table 4.13 Correlations between reading speed and all three parameters used to measure absorption.

Additional measures were also analysed. These included the global variables of dwell time in a subtitle as a percentage of the visible time of the respective subtitle (in other words, how long someone spent reading the subtitle while the subtitle was on-screen), as well as dwell time in subtitles per language (Afrikaans or English) as a percentage of the visible time of the respective subtitled language (in other words, how long someone spent reading the Afrikaans or English subtitles calculated for the entire time the subtitles were visible in the respective language). Negative correlations were found for these measures as well.

In terms of Cohen’s scale of effect sizes, a correlation was found between reading speed in particular and the global variable of dwell time per language as a percentage of the total visible time of the subtitled language. As can be seen in Table 4.14 there was a greater effect for Afrikaans ($r = - 0.4115$) than for English ($r = - 0.1648$) subtitle reading. This means that, for

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

Afrikaans readers, the relation between how fast they read the static text and its influence on how fast they read the subtitles was greater than for English readers. More specifically, the effect size was greatest for the Afrikaans control group CAA ($r = -0.5291$). A small to medium effect was found for the Afrikaans subtitle reading of test groups TAE and TEA combined ($r = -0.2582$) as well as for the English control group CEE ($r = -0.2058$). A small effect was found for the English subtitle reading of test groups TAE and TEA combined ($r = -0.0975$).

Correlations: Reading speed vs. Dwell time				
Group	Lang	Dwell time as % of Visible time	p	N
AFRIKAANS	A	-0.4115	0.00	1235
ENGLISH	E	-0.1648	0.00	1100
CAA	A	-0.5291	0.00	620
TAE & TEA	A	-0.2582	0.00	615
CEE	E	-0.2058	0.00	522
TAE & TEA	E	-0.0975	0.00	578

Table 4.14 Correlations between reading speed and dwell time as a percentage of the visible time of the respective subtitle languages (per language overall and per group).

In order for reading speed to explain the differences in subtitle reading for groups TEA, TAE and CEE, control group CEE would have had to read English text faster than TAE, while reading English text at approximately the same speed as TEA. As is evident from the findings, neither of these conditions was satisfied. In fact, TAE, which was thought to contain slower readers turned out to read English static text the fastest of all the groups. Therefore, although participants' reading speed measured for their reading of static text did have a statistically significant correlation with the processing of subtitles and passed the first and second criteria, it failed the third by not meeting the conditions of participant distribution. In this regard the reading speed of participants does not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2.

Vertical movement

In terms of vertical movement the effect sizes for correlations with reading speed were overall small and positive. Effects were bigger for English control and test groups than for Afrikaans control and test groups, but the effects stayed small and never increased in size. In other words, there was a correlation between reading speed and vertical movement for the reading of English subtitles, meaning that the faster the participants read the static text, the more vertical jumps

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

were made between the subtitled area and the rest of the visuals above it. However, this effect was small throughout.

Correlations: Reading speed vs. Vertical movement						
Group	Lang	Glances count		Revisitors count		N
		r	p	r	p	
CAA	A	0.0482	0.231	0.0427	0.288	620
TAE & TEA	A	0.1107	0.006	0.1127	0.005	620
CEE	E	0.2027	0.000	0.1690	0.000	522
TAE & TEA	E	0.1608	0.000	0.1589	0.000	580

Table 4.15 Correlations between reading speed and the two parameters used to measure vertical movement.

Vertical movement was not analysed in more detail because it was not part of the primary focus of the study.

Subtitle reading speed

Analyses of the individual subtitles showed that Afrikaans subtitles contained an average of 8.6 words while English subtitles contained an average of 8.2 words. Based on the visible time of the subtitles (the time that the subtitles were on-screen) and the notion that the average word in English and Afrikaans consist of 4.7 and 4.8 characters per word respectively (cf. footnote 37, section 4.3.1), the imposed reading speed and subtitle presentation rate overall was calculated as 161 wpm and 162 wpm for the English and Afrikaans subtitles respectively. The separate values for one-line and two-line subtitles can be seen in Table 4.16 below:

Imposed reading speed and presentation rate based on subtitle visibility					
Lang	Lines	Word count (average)	Visible time total [ms] (average)	Imposed read speed [wpm] (average)	
				wpm	Cps
A	1	6.2	2593	144	12
A	2	11.0	3828	175	14
A	1 + 2	8.6	3110	162	13
E	1	5.9	2638	135	11
E	2	11.1	3865	175	14
E	1 + 2	8.2	3442	161	13

Table 4.16 Imposed reading speed calculated according to the visible time and average word count of one-line and two-line subtitles per language group.

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

However, these values only represent the imposed reading speed with which participants were to read the subtitles, and not the actual reading speed with which the subtitles were in fact read. In order to calculate participants' actual reading speed, four measures were used: the total word count of the subtitles, the total visible time of the subtitles, the total dwell time of participants in the subtitled area, and the duration of the video starting when the first subtitle appeared and ending when the last subtitle disappeared. Based on these values, actual reading speeds were calculated per visible time, per dwell time, and for the duration of the film (see Table 4.17).

Reading speed in terms of subtitle visibility, dwell time and film duration							
	Words	Viewing parameters					
Group	Total word count for film	VT of subtitles [sec.]	Reading speed per VT [wpm]	DT in subtitles [sec.]	Reading speed per DT [wpm]	Film duration: subtitled section [sec.]	Reading speed for film: subtitled section [wpm]
CAA	5220	2052.4	152.6	1403.9	223.1	2906.0	107.8
TAE	5090	2013.2	151.7	1384.1	220.6	2906.0	105.1
TEA	5110	2035.2	150.6	1358.7	225.7	2906.0	105.5
CEE	4482	1796.8	149.7	1113.0	241.6	2615.4	102.8

Table 4.17 Calculation of participants' actual reading speed per visible time (VT) of the subtitles and dwell time (DT) in the subtitles, using the duration of the film (starting when the first subtitle appeared and ending when the last subtitle disappeared).

An estimated reading time per word was also calculated by dividing the total dwell time of participants within the individual subtitles by the number of words they contained. This can be seen in Table 4.18 below.

Calculated reading speed for subtitle reading				
Group	Lang	Half	Reading time [ms]	
			Means	Std.Dev.
ALL	A + E	1 + 2	272.3	96.6
CAA	A	1	274.9	100.5
CAA	A	2	281.5	109.5
TAE	A	1	270.3	89.4
TEA	A	2	277.7	99.5
CEE	E	1	261.9	89.3
CEE	E	2	246.7	76.8
TEA	E	1	269.1	102.3
TAE	E	2	291.4	92.8

Table 4.18 The estimated reading time per word calculated per language per group in milliseconds.

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

For Afrikaans subtitles overall, a negative correlation ($r = - 0.37$) was found for static text reading speed and subtitle reading time per word. A negative correlation was also found for English ($r = - 0.12$). Both correlations were statistically significant ($p < 0.05$) but very small – in terms of Cohen’s practical significance, the effect sizes for Afrikaans and English were medium and small respectively. The negative correlation was expected – one would think that the quicker the reading speed, the less time would be spent reading each word; the effect sizes, however, were unexpectedly small. The small effect size for English means that the degree of advantage being a faster reader holds for English subtitle reading is much lower (1.4%) than for Afrikaans (13.7%). Therefore, although participants’ reading speed for static text had an effect on subtitle reading, it does not invalidate the findings for the differences found in subtitle reading. For this to have been the case, the benefit for English subtitle reading would have had to be greater. Furthermore, from Table 4.18 it is clear that the two most extreme values originated from the same data set – test group TAE and control group CEE read the exact same English subtitles during the second half of the film, yet participants in CEE spent the least amount of time reading per word (246.7 ms) while participants in TAE spent the most time reading per word (291.4 ms). As the difference here cannot be attributed to subtitle content (the subtitles were exactly the same), the difference has to be inherent to L1 versus L2 subtitle reading, which supports the research hypothesis.

The overall reading speeds for Afrikaans and English static text and subtitle reading can be seen in Table 4.19.

Comparison of reading speed for subtitle and static text reading						
Variable	Afrikaans		English read by L1 speakers		English read by L2 speakers	
	Means	Std.Dev.	Means	Std.Dev.	Means	Std.Dev.
Static text reading speed [wpm]	201.97	56.48	182.89	35.55	186.05	50.41
Subtitle reading time per word [ms]	276.1	100.22	254.02	83.33	280.65	98.04

Table 4.19 A comparison of reading speed for static text (wpm) and subtitle reading (ms) as calculated for Afrikaans and English overall.

However, these reading speeds are not directly comparable as they were not calculated in the same unit of measure (wpm vs. reading time [ms] per word). If the subtitle reading time per word

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

(ms) were to be converted to a reading speed of words per minute, 276.1 ms per word would correspond to a reading speed of 217 wpm for Afrikaans subtitles, while 254.02 ms per word and 280.65 ms per word would correspond to reading speeds of 236 wpm and 214 wpm for L1 and L2 English subtitles respectively. This conversion was done by recalculating the reading time per word in milliseconds to a reading time per word in seconds (0.276 s, 0.254 s and 0.280 s respectively) and then converting this to a reading speed per minute by using 60 (seconds) as the dividend and each of the recalculated reading times per second as the dividers (i.e. $60/0.276 = 217$ wpm; $60/0.254 = 236$ wpm and $60/0.280 = 214$ wpm). The rescaled values are reflected in Table 4.20 below.

Comparison of reading rate for subtitle and static text reading						
Variable	Afrikaans		English read by L1 speakers		English read by L2 speakers	
	Means	Std.Dev.	Means	Std.Dev.	Means	Std.Dev.
Static text reading rate [wpm]	202	56	183	36	186	50
Subtitle reading rate [wpm]	217	79	236	77	214	75

Table 4.20 A comparison of reading rate for static text and subtitle reading (wpm) as calculated for Afrikaans and English overall.

This represents the estimated reading speed for only the subtitle text reading, not for the combined effort of reading and viewing the visuals simultaneously. In other words, this is the average reading speed for the total amount of time spent dwelling in the respective subtitles. When comparing this value with the reading speed for static text, it is interesting to note that, for subtitle reading, the Afrikaans L1-speaking participants read the L1 Afrikaans and L2 English subtitles very similarly (217 wpm and 214 wpm respectively) whereas for static text reading a distinct difference was found – the Afrikaans text was read faster (199 wpm) than the English text (186 wpm). Both these findings can be explained by the availability of reading materials in Afrikaans – the Afrikaans participants read the Afrikaans static text faster because it is their L1 and they do (and have done) a lot of L1 static text reading over the years; in terms of subtitle reading, however, they do not have any experience in reading Afrikaans subtitles, which is why they are not as proficient in their reading thereof. This does not go to say that they did not read the Afrikaans subtitles efficiently – on the contrary, they would have read the Afrikaans subtitles even better if they were exposed to Afrikaans subtitles more regularly.

4.4.1.2 Correlation between reading comprehension and subtitle reading

The findings for reading comprehension were not as significant as the findings for reading speed. Positive correlations were found for CAA (Afrikaans) and TAE and TEA (English), while negative correlations were found for TAE and TEA (Afrikaans) and CEE (English).

In terms of the global variable of dwell time per language as a percentage of the total visible time of the subtitled language, only two significant effects were found – a negative correlation for the English control group CEE ($r = -0.2617$) and a positive correlation for the Afrikaans control group CAA ($r = 0.1764$).

Correlations: Reading comprehension vs. Dwell time				
Group	Lang	Dwell time as % of Visible time	p	N
CAA	A	0.1764	0.000	620
TAE & TEA	A	-0.0406	0.077	615
CEE	E	-0.2617	0.000	522
TAE & TEA	E	0.0643	0.122	578

Table 4.21 Correlations between reading comprehension and dwell time as a percentage of the visible time of the respective subtitle languages (per language overall and per group).

The negative correlation for the English control group CEE coincides with the findings for reading speed and means that greater comprehension corresponds to less time being spent in the subtitle – participants in CEE need not have spent a lot of time reading the subtitle in order to understand what was being said. The opposite effect was found for the Afrikaans control group CAA – for participants in CAA greater comprehension corresponded to more time being spent in the subtitled area. In other words, when comparing the subtitle reading of Afrikaans L1 and English L1 viewers, the groups clearly used different reading strategies. The Afrikaans viewers read the subtitles in a style that resembled that of static text reading – they read the text, and only after having finished reading did they look away. The English viewers, however, adopted a very different strategy when reading the subtitles – they did not read the subtitled text like static text, but like subtitles, meaning that they did not depend solely on the text for their comprehension of the storyline. Instead, they made use of all the channels that conveyed information. This is reflected not only in the values for dwell time as a percentage of the visible time of the subtitles, but also in the findings for vertical movement (the English L1 viewers made considerably more vertical movements than the Afrikaans L1 viewers, cf. sections 4.3.2.2 and 4.3.3.2). The

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

conclusion to be drawn from the conflicting findings (the presence of both negative and positive correlations) is that not enough is known and understood about the relation between reading comprehension and subtitle reading – the positive correlation reflecting longer reading time for better comprehension is very strange, and the fact that the correlations differ for control groups CAA and CEE does not make sense. In addition, the fact that no effect was found for the Afrikaans L1 speakers in test groups TAE and TEA makes it impossible to draw any conclusions about the Afrikaans L1 readers in this regard.

With regards to absorption, the effects for reading comprehension were all small. Some were significant, but the effects were too small to be considered as alternative explanations for the observed patterns of the dependent variables.

Correlations: Reading comprehension vs. Absorption parameters								
Group	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		r	p	r	p	r	p	
CAA	A	0.1228	0.002	0.141	0.000	0.1119	0.005	620
TAE & TEA	A	-0.0298	0.459	-0.0310	0.440	-0.0599	0.136	620
CEE	E	-0.1868	0.000	-0.2051	0.000	-0.1529	0.000	522
TAE & TEA	E	0.0475	0.253	0.0537	0.196	-0.0346	0.406	580

Table 4.22 Correlations between reading comprehension and all three parameters used to measure absorption.

The negative correlations found for reading comprehension and subtitle reading constitute a linear effect in the hypothesized direction, but because this was not found for all groups, reading comprehension failed the second criterion. Consequently, although reading comprehension correlated significantly with subtitle reading it does not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2.

The effects for reading comprehension and vertical movement were equally small as can be seen in Table 4.23.

Correlations: Reading comprehension vs. Vertical movement						
Group	Lang	Glances count		Revisitors count		N
		r	p	r	p	
CAA	A	-0.0865	0.031	-0.1209	0.003	620
TAE & TEA	A	0.0459	0.254	0.0527	0.190	620
CEE	E	0.1760	0.000	0.1409	0.001	522
TAE & TEA	E	-0.0782	0.060	-0.0796	0.056	580

Table 4.23 Correlations between reading comprehension and the two parameters used to measure vertical movement.

Vertical movement was not analysed in more detail because it was not part of the primary focus of the study.

4.4.1.3 Conclusion

Based on the findings given above, reading speed and reading comprehension can be ruled out as confounding variables that might have influenced the eye-tracking data for subtitle reading. These two variables did have effects on subtitle reading, but the effects were similar across all groups, meaning that it could not explain the differences that were observed for subtitle reading between the groups.

When considering the effect of **reading speed** on **subtitle absorption**, all four groups (TAE, TEA, CAA, CEE) displayed a negative correlation, meaning that participants in all four the groups spent less time reading and processing the subtitles as the reading speed for static text increased. In other words, participants who read the static text the fastest generally spent less time reading the subtitles. This was found for all for groups in terms of all three parameters used to measure absorption (dwell time total, fixation time total and fixation count). This effect was greatest for control group CAA, but as this group read only Afrikaans subtitles and there were no significant findings for the reading of Afrikaans subtitles, this can be disregarded. The same can be said of the fact that the correlation found between reading speed and the global variable of dwell time per language as a percentage of the total visible time of the subtitled language had a greater effect for Afrikaans than for English subtitle reading. In fact, all three groups that read English subtitles (CEE, TEA and TAE) displayed the smallest effects in terms of correlations with reading speed. Reading speed therefore does not explain the deviations found in the eye-tracking data for the reading of English subtitles. Furthermore, CEE did not read the static text faster than TAE, which one would have expected because CEE read the subtitles much faster

than TAE. In this sense reading speed does not account for the findings of the eye-tracking data either.

Overall positive and small correlations were found between **reading speed** and **vertical movement**, meaning that a faster reading speed in terms of words per minute resulted in more vertical movements being made. However, although effects were bigger for the English control and test groups than for the Afrikaans control and test groups in this case, the effects were consistently small for all groups. A small effect size could not account for the large deviations found in the vertical movements made by test groups TAE and TEA as compared to control group CEE when reading English subtitles and can therefore be excluded as a possible influence on subtitle reading.

In terms of the relation between the **reading speeds of static text and subtitle reading** varying effects were found – the Afrikaans L1-speaking participants read the Afrikaans subtitles slower per word (276 ms) than the English L1-speaking participants read the English subtitles (254 ms), but they read the Afrikaans subtitles very similarly to the L2 English subtitles (281 ms). In terms of static text reading, however, the Afrikaans L1-speaking participants read the Afrikaans text faster overall (202 wpm) than the English text when read as either L1 (183 wpm) or L2 (186 wpm) text. This effect might be attributed to familiarity – Afrikaans texts are more readily available for reading than Afrikaans subtitles, meaning that the Afrikaans L1-speaking participants have honed their reading skills for static text reading but not for Afrikaans subtitle reading. English subtitles are read more often, which might explain why they are read faster in terms of reading time per word. However, faster reading does not imply better reading – the primary findings of this study indicate that the Afrikaans L1-speaking participants needed more time to read the English subtitles than the English L1-speaking participants in terms of processing.

Correlations between **comprehension scores** and **absorption** offered only small effects. The biggest effect was a negative correlation found for control group CEE between comprehension and the global variable of dwell time per language as a percentage of the total visible time of the subtitled language. The opposite effect was found for control group CAA, the only other significant effect. These findings are contradictory to those for reading speed where effect was greatest for CAA and smallest for CEE, implying that a faster reading speed does not always coincide with better comprehension. Other effects for comprehension, though sometimes

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

significant, were too small to have had an effect on subtitle reading. The same can be said of the correlations between **comprehension scores** and **vertical movement**.

Due to consistent, small effects for both reading speed and comprehension scores, both these variables can be excluded as possible explanations for the patterns found in the eye-tracking data of subtitle reading, namely that the English L1-speaking participants in control group CEE read the English subtitles much faster and easier than did the Afrikaans L1-speaking participants in test group TAE during the second half of the film, and that the English L1-speaking participants generally made more vertical movements during subtitle viewing than did the Afrikaans L1-speaking participants (except for TAE when reading English subtitles during the second half of the film). Furthermore, although the variables passed the first two of the three criteria (statistically significant effect and linear relation) to varying extents, none offered a valid alternative to support the hypothesis that the differences observed for subtitle reading could be attributed to these confounding factors rather than the differences between reading in the first or second language. For this to have been the case, the variables would have had to pass all three criteria, especially the third (participant distribution), which none of the variables were able to do.

4.4.2 Subtitle length

Subtitle word and character counts were taken into consideration for the analysis. No distinction was made between one-line and two-line subtitles as it is obvious that a two-line subtitle contained more words and characters than a one-line subtitle.

4.4.2.1 Correlation between subtitle length and subtitle reading

A very strong, positive correlation was found between subtitle length and absorption.

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

Correlations: Word count vs. Absorption parameters								
Group	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		r	p	r	p	r	p	
CAA	A	0.6147	0.000	0.5843	0.000	0.6791	0.000	620
TAE & TEA	A	0.6473	0.000	0.6061	0.000	0.6914	0.000	620
CEE	E	0.6918	0.000	0.6528	0.000	0.7195	0.000	522
TAE & TEA	E	0.6627	0.000	0.6246	0.000	0.7090	0.000	580

Table 4.24 Correlations between word count and all three parameters used to measure absorption.

Correlations: Character count vs. Absorption parameters								
Group	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		r	p	r	p	r	p	
CAA	A	0.6649	0.000	0.6335	0.000	0.7134	0.000	620
TAE & TEA	A	0.7023	0.000	0.6599	0.000	0.7374	0.000	620
CEE	E	0.7294	0.000	0.6880	0.000	0.7540	0.000	522
TAE & TEA	E	0.7123	0.000	0.6731	0.000	0.7498	0.000	580

Table 4.25 Correlations between character count and all three parameters used to measure absorption.

In other words, the longer a subtitle, the more time was spent processing that particular subtitle. This was found for all groups in terms of both word count (Table 4.24) and character count (Table 4.25). The overall correlation between word count and the amount of time spent in the subtitles (dwell time) was also high ($r = 0.65$). This finding was expected as it makes sense that someone would spend more time reading a subtitle (or any reading material) that contains more text. The correlations were statistically significant, and as the findings were expected, they measured in the hypothesized direction.

The differences between the groups were very small – correlations were of equal strength. Correlations for Afrikaans and English reading in general were also very similar. The highest correlations between word count and dwell time were found for test groups TAE and TEA ($r = 0.66$) and control group CEE ($r = 0.69$) for their reading of English subtitles as compared to the correlations for the test of the groups. In order to satisfy the conditions set by the third criteria to refute the research hypothesis that subtitle reading differs for L1 and L2 reading, the correlations for CEE and TAE would have had to differ greatly. However, as they read the same subtitles with the same amount of words, their respective correlations were nearly equivalent. Therefore, although subtitle length correlated significantly with subtitle reading, the correlations were consistent for all groups and therefore do not explain the differences in subtitle reading and does

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

not refute the research hypothesis. In fact, because these groups read the exact same subtitles, these findings indicate very strongly that an extratextual factor had to be behind the observed differences in subtitle reading.

Furthermore, no significant correlations were found between subtitle length and vertical movement – effect sizes were very small and insignificant for all groups ($r < 0,1$; $p > 0,05$). Vertical movement was not analysed in more detail because it was not part of the primary focus of the study.

4.4.2.2 Conclusion

Based on the abovementioned findings, subtitle length in terms of both word and character count can be ruled out as a confounding variable that explains the differences in the eye-tracking data for subtitle reading. Participants in all groups spent more time reading subtitles that were longer; the effect was therefore the same for all participants in terms of processing. In the case of vertical movement the lack of significance was also the same for all participants – the length of the subtitles did not affect the vertical movements of any of the participants in any of the groups. Subtitle length therefore cannot be held accountable for the deviations found in the eye-tracking data and therefore does not refute the research hypothesis that subtitle reading differs for L1 and L2 reading.

4.4.3 Questionnaire data

Data collected in the questionnaire was analysed in terms of two categories: participants' reading and television viewing habits, and participants' attitude toward reading subtitles. Participant demographics were not used for statistical analyses because of the lack of variance (cf. section 4.2).

Participants responded to questions on how much time was spent reading static text (Reading habit), reading subtitles (Subtitle reading habit) and watching television (Television viewing habit) in a week, and whether they liked watching local and imported soap operas. In terms of subtitle reading, participants were asked if they preferred to watch local and imported television programmes with or without subtitles, how often they read L2 subtitles (L2 subtitle reading habit) and whether they liked to read subtitles at all. Each variable is evaluated against the three

criteria to see if it could explain the differences found in subtitle reading. In other words, the following three questions had to be asked:

- Did it have a significant effect on subtitle reading?
- If so, was the effect linear and in the hypothesized direction? (i.e. did it hold an advantage for subtitle reading?)
- If so, did it agree with the distribution pattern found for the observed difference in subtitle reading? (i.e. did the findings for each variable agree with the findings for subtitle reading?)

All three these conditions had to be satisfied for each of the variables individually in order for that variable to explain the differences found for subtitle reading. The findings for each of the variables are discussed in the sections to follow.

4.4.3.1 Reading habit

The regularity with which participants read static text was found to have a statistically significant effect for both dwell time ($F(2, 2277)=7.33, p<0.05$) and fixation time ($F(2, 2277)=13.01, p<0.05$). However, despite this significant interaction, the relationship between reading and dwell time and fixation time was not linear.

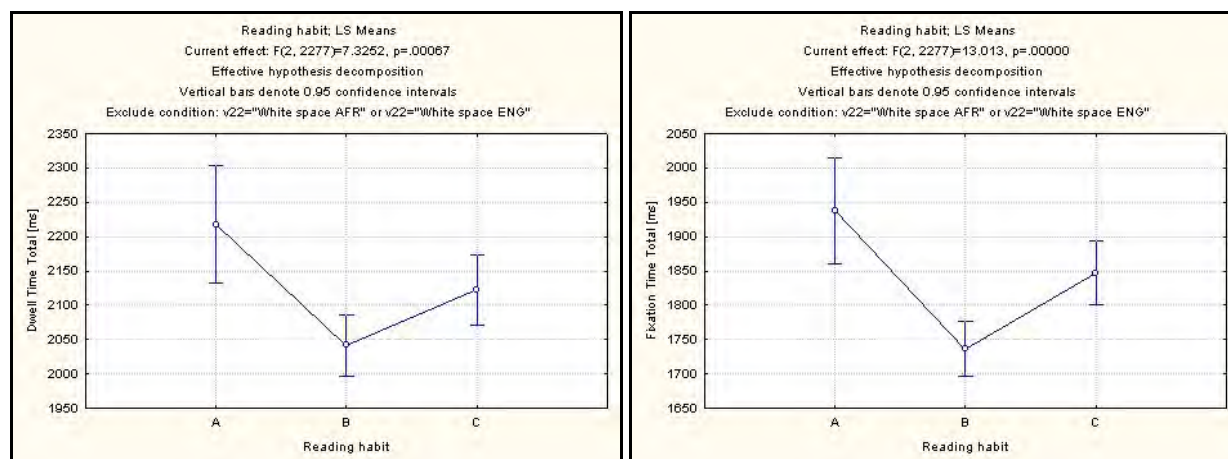


Figure 4.1 Graphs indicating the non-linear interaction of participants' reading habit with dwell time (left) and fixation time (right).

The observed effect therefore provides no explanation for a possible pattern for dwell time and fixation time because, while the group who likes reading least (A) has the longest dwell and fixation times, the middle group (B) has the shortest and the group that reads the most (C) has an

intermediate value. In other words, the reading habits of participants do not offer a competing explanation for the difference in L2 and L1 reading of English subtitles found for groups TAE and CEE, as those participants who read most were not the quickest readers of subtitles. Although having passed the first criterion (statistically significant effect), this variable failed the second (linear relation). It therefore does not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2.

4.4.3.2 Subtitle reading habit

A significant effect was found for participants' habitual reading of subtitles for both dwell time ($F(2, 2216)=11.43, p<0.05$) and fixation time ($F(2, 2216)=11.47, p<0.05$). The effect found was linear, but in the unexpected direction. In other words, instead of more regular reading of subtitles leading to the easier processing thereof (by spending less time reading the subtitles), the opposite pattern was found.

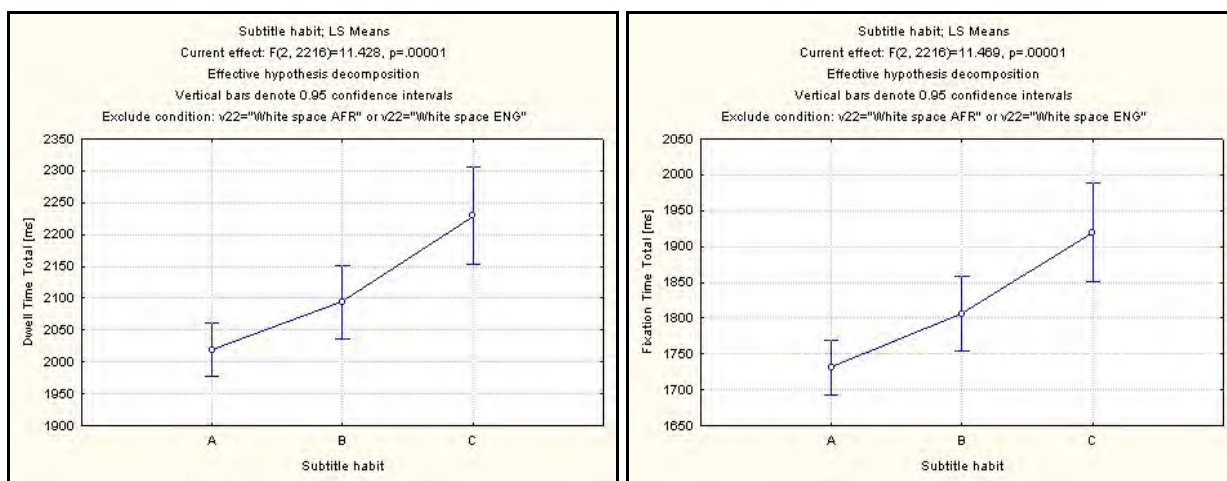


Figure 4.2 Graphs indicating the reversed linear interaction of participants' subtitle reading habit with dwell time (left) and fixation time (right).

Participants who stated that they read subtitles on a regular basis (C) were found to spend the most time reading the subtitles, while those who stated they read very few (B) to no subtitles (A) were found to read and process the subtitles much quicker. Therefore, although subtitle reading habit passed the first criterion by having a statistically significant effect on subtitle reading, it failed the second and third criteria (linear relation and participant distribution). It therefore does not explain the difference in the eye-tracking data found for TAE and CEE for their L2 and L1 reading of English subtitles, and hence does not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2.

4.4.3.3 Television viewing habit

It was found that the television viewing habits of participants did have a statistically significant effect on subtitle viewing in terms of both dwell time ($F(2, 2277)=6.17, p<0.05$) and fixation time ($F(2, 2277)=8.32, p<0.05$), specifically that the more participants watched television per week, the more easily they read and processed the subtitles (by spending less time reading them). The effect was therefore linear.

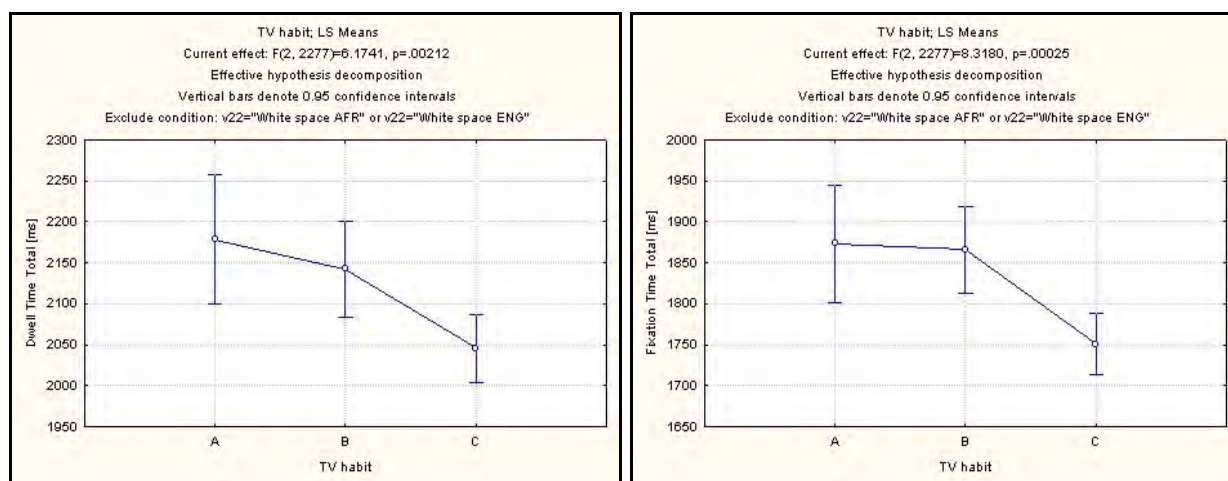


Figure 4.3 Graphs indicating the linear interaction of participants’ television viewing habit with dwell time (left) and fixation time (right).

This raises the possibility that the difficulty experienced by TAE in reading the English subtitles in the second half of the film may be due to differences in the television viewing habits of the participants. This possibility may provide an alternative account of the difference in L2 and L1 reading of English subtitles found for TAE and CEE, but, in terms of the third criterion, only if the TAE group watched less television than CEE, and CEE watched the same amount of television as TEA (for whom the processing of the English subtitles in the first half of the film occurred with the same ease). Only one of these conditions was satisfied.

Television viewing habit						
Rating	Dwell time [ms] (means)	Fixation time [ms] (means)	CAA	CEE	TAE	TEA
A	2178.576	1873.123	1	1	2	2
B	2142.614	1866.251	1	3	3	4
C	2045.320	1750.580	8	6	4	4
All Groups			10	9	9	10

Table 4.26 Crosstabulations of television viewing habits for the respective groups based on the number of subtitles read per participant. The means are also given for dwell time and fixation time per reading category rated from A (none to few times per week) to C (many times per week) as calculated by means of ANOVAs.

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

Results showed that CEE did watch more television per week than TAE, but that CEE also spent more time watching television than test group TEA. This means that this variable does not pass the third criterion. Therefore, although television viewings habits did have a statistically significant, linear effect on the processing of subtitles and passed the first and second criteria, it failed the third by not satisfying the conditions of participant distribution. Consequently the television viewing habits of participants do not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2.

4.4.3.4 Like to watch local soap operas

A significant effect was found for participants' liking of local soap operas in terms of both dwell time ($F(3, 2217)=21.37, p<0.05$) and fixation time ($F(3, 2217)=22.86, p<0.05$). However, although the effect was semi-linear, it was not in the expected direction – those who liked local soap operas the most spent the most time reading the subtitles, while those who liked it least spent the least time reading the subtitles.

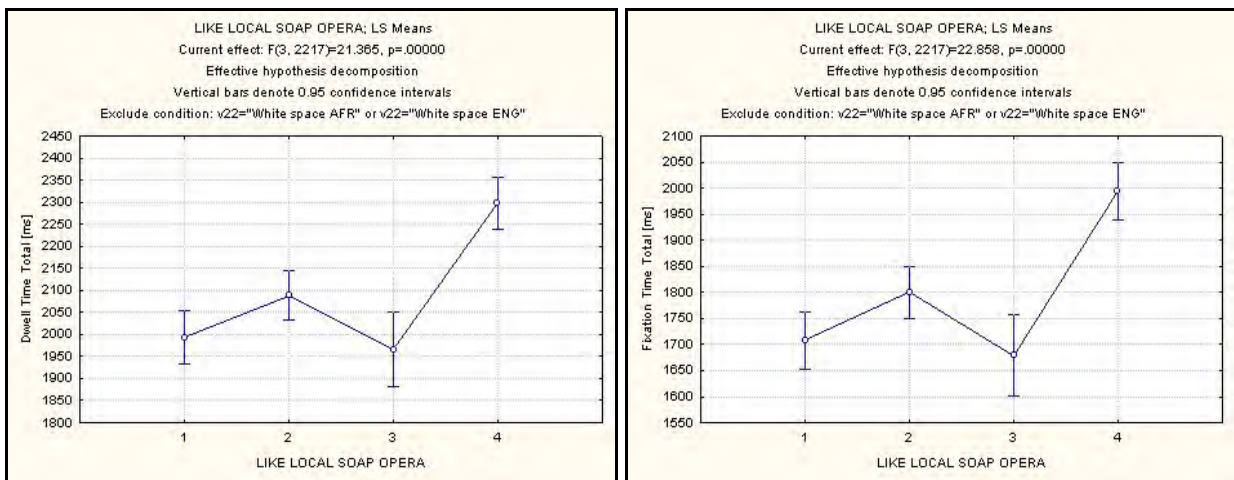


Figure 4.4 Graphs indicating the semi-linear, reversed interaction of participants' liking of local soap operas with dwell time (left) and fixation time (right).

One would have expected that participants who liked to watch local soap operas more would have read and processed subtitles more easily because this type of subtitled programming is prevalent on South African television during prime time broadcasting, but this was not the case. Therefore, despite having passed the first criterion (statistically significant effect), this variable failed the second (linear relation in the hypothesized direction) and third (participant distribution). Consequently participants' liking of local soap operas does not provide an

alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2.

4.4.3.5 Like to watch imported soap operas

Participants' liking of imported soap operas was found to have a statistically significant effect for both dwell time ($F(3, 2334)=29.15, p<0.05$) and fixation time ($F(3, 2334)=32.54, p<0.05$). However, despite this significant interaction, the relationship between the extent to which participants liked to watch imported soap operas and dwell time and fixation time was not linear. As with local soap operas one would have expected that participants who liked to watch imported soap operas more would have read and processed subtitles more easily because this type of programming is prevalent on South African television.

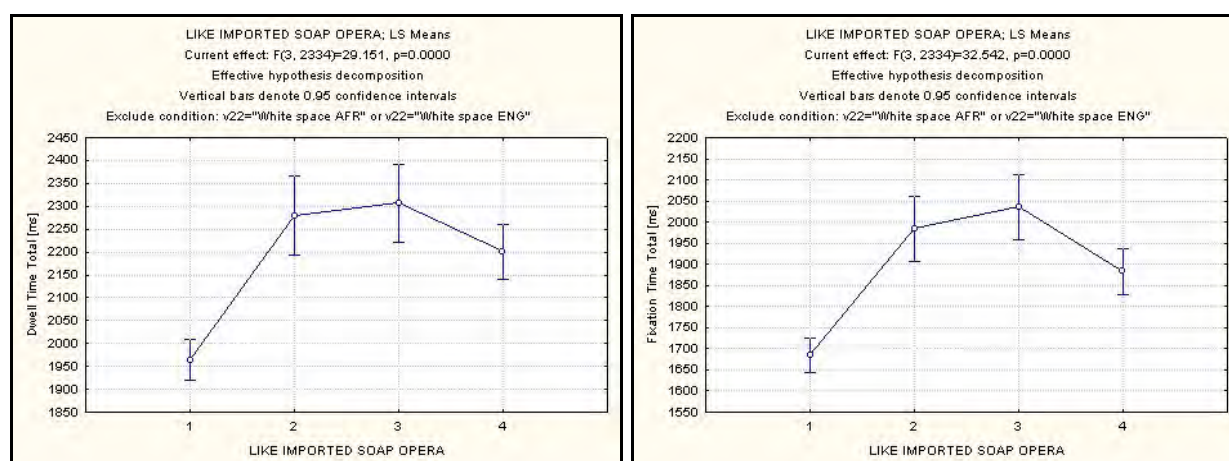


Figure 4.5 Graphs indicating the non-linear interaction of participants' liking of imported soap operas with dwell time (left) and fixation time (right).

Despite having passed the first criterion (statistically significant effect), this variable failed the second (linear relation). The observed effect therefore provides no explanation for a possible pattern for dwell time and fixation time. In other words, participants' liking of imported soap operas does not explain the difference in L2 and L1 reading of English subtitles found for groups TAE and CEE and therefore does not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2.

4.4.3.6 Prefer local television programmes with or without subtitles

ANOVAs showed no significant effect for participants’ preference for watching local television programmes with or without subtitles. In other words, whether participants preferred to watch local television programmes with or without subtitles had no effect on their reading of subtitles in the current experiment. This variable therefore does not pass the first criterion (statistically significant effect) and consequently cannot present an alternative account of the difference in L2 and L1 reading of English subtitles by TAE and CEE. Preference for watching local television programmes with or without subtitles therefore does not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2.

4.4.3.7 Prefer imported television programmes with or without subtitles

Participants’ preference for watching imported television programmes with or without subtitles did have a significant effect on their subtitle reading in terms of both dwell time ($F(1, 2338)=42.91, p<0.05$) and fixation time ($F(1, 2338)=49.75, p<0.05$). Furthermore, this effect was linear. In other words, participants who preferred to watch imported television programmes with subtitles read and processed the subtitles more easily (by spending less time reading them).

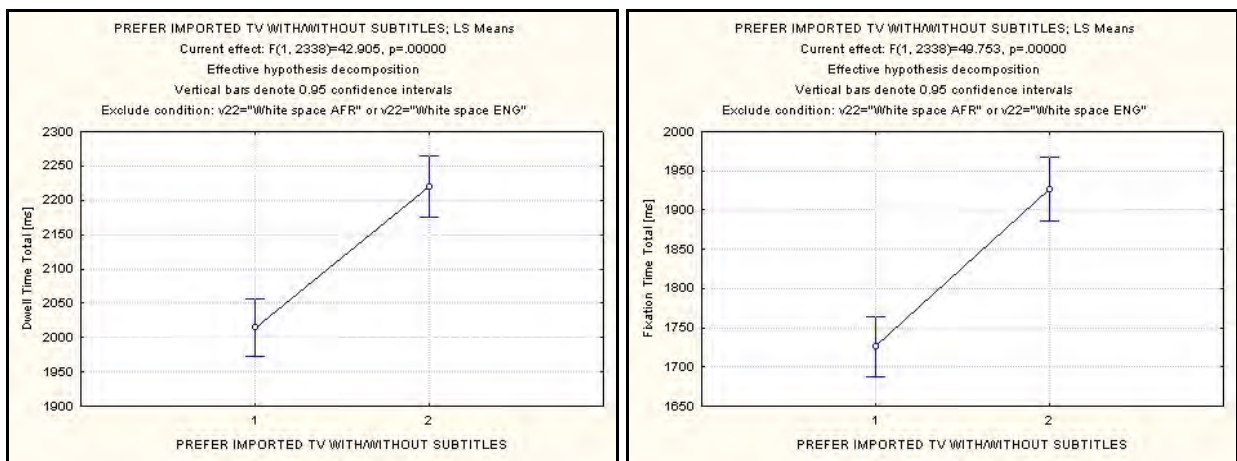


Figure 4.6 Graphs indicating the linear interaction of participants’ preference to view imported television programmes with or without subtitles with dwell time (left) and fixation time (right).

This means that the difficulty experienced by TAE in reading the subtitles in the second half of the film might be due to the difference in participants’ preference for subtitles. This possibility may therefore provide an alternative account for the difference in L2 and L1 reading of English subtitles found for TAE and CEE, but only if the following conditions were satisfied: if

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

participants in CEE and TEA preferred to watch imported television programmes with subtitles to the same extent, and if CEE showed a greater preference for subtitles than TAE. Only the second condition was satisfied.

Prefer imported television programmes with or without subtitles						
Rating	Dwell time [ms] (means)	Fixation time [ms] (means)	CAA	CEE	TAE	TEA
1	2014.086	1725.904	3	7	8	4
2	2219.296	1926.526	7	2	2	6
All Groups			10	9	10	10

Table 4.27 Crosstabulations of participants' preference to watch imported television programmes with or without subtitles for the respective groups based on the number of subtitles read per participant. The means are also given for dwell time and fixation time per category rated from 1 (with subtitles) to 2 (without subtitles) as calculated by means of ANOVAs.

Participants in control group CEE showed a greater preference for subtitles than test group TEA, which contradicts the first condition. Furthermore, participants in test group TAE showed a greater preference for subtitles than control group CEE, which is the opposite of the second condition. By passing the first and second criteria (statistically significant effect and linear relation), preference for watching imported programmes with subtitles might have had an effect on subtitle reading, but because it failed the third (participant distribution), it does not explain the different eye-tracking findings for L1 and L2 reading of English subtitles by CEE and TAE. It therefore does not provide an alternative explanation to refute the research hypothesis that reading differs for L1 and L2.

4.4.3.8 L2 subtitle reading habit

A significant effect was found for participants' habitual reading of L2 subtitles for both dwell time ($F(3, 2334)=15.16, p<0.05$) and fixation time ($F(3, 2334)=19.44, p<0.05$). The effect found was linear, but not in the expected direction – instead of more regular reading of L2 subtitles leading to the easier processing thereof (by spending less time reading the subtitles), the opposite pattern was found.

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

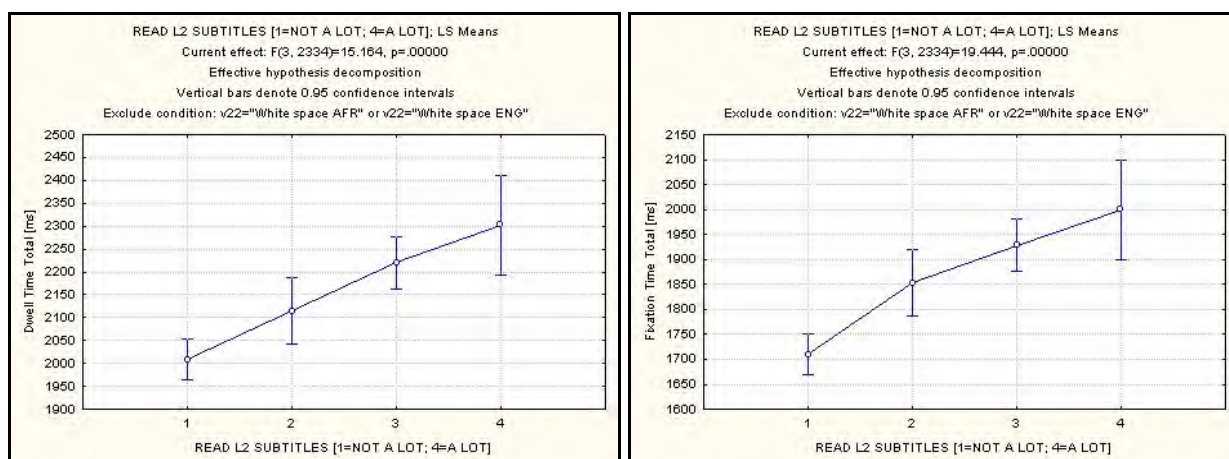


Figure 4.7 Graphs indicating the reversed linear interaction of participants' L2 subtitle reading habit with dwell time (left) and fixation time (right).

Participants who stated that they read L2 subtitles on a regular basis (3 and 4) were found to spend the most time reading the subtitles, while those who stated they read very few (2) to no subtitles (1) were found to read and process the subtitles much quicker. Therefore, although L2 subtitle reading habit passed the first criterion by having a statistically significant effect on subtitle reading in the current study, it failed the second and third criteria (linear relation and participant distribution) and therefore does not explain the difference in the eye-tracking data found for TAE and CEE for L2 and L1 reading of English subtitles. Participants' L2 subtitle reading habit therefore does not provide an alternative explanation to refute the hypothesis that subtitle reading differs for L1 and L2.

4.4.3.9 Like to read television subtitles

The regularity with which participants read subtitles on television was found to have a statistically significant effect for dwell time ($F(3, 2334)=2.91, p<0.05$). The effect for fixation time was not statistically significant ($F(3, 2334)=2.49, p>0.05$). Furthermore, the relationship between reading and dwell time and fixation time was not linear.

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

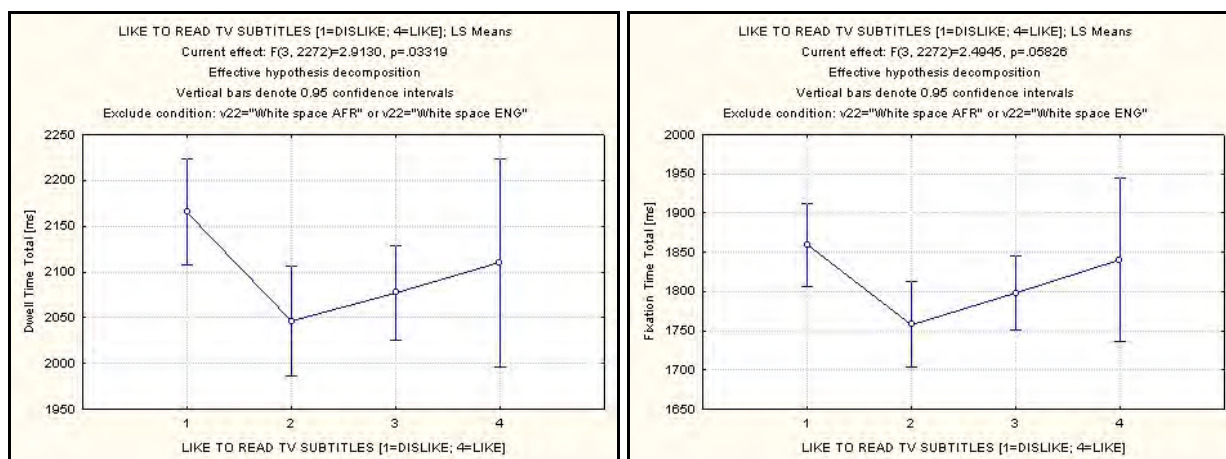


Figure 4.8 Graphs indicating the non-linear interaction of participants' liking of television subtitles with dwell time (left) and fixation time (right).

The observed effect therefore provides no explanation for a possible pattern for dwell time and fixation time because, while the group who likes reading subtitles least (1) has the longest dwell and fixation times, the middle groups (2 and 3) have the shortest and second shortest reading times respectively, and the group that likes reading subtitles the most (4) has an intermediate value. In other words, although having passed the first criterion (statistically significant effect), this variable failed the second (linear relation). Consequently whether participants like or dislike reading television subtitles does not explain the difference in L2 and L1 reading of English subtitles found for groups TAE and CEE. It therefore cannot provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2.

4.4.3.10 Conclusion

As mentioned earlier, the potential confounding variables passed the three criteria to a varying extent. However, in the end none offered a valid justification to support an alternative hypothesis that the differences observed for subtitle reading could be attributed to factors other than L1 and L2 reading as can be seen in Table 4.28 below.

Summary of findings for alternative hypotheses				
	Criterion 1	Criterion 2	Criterion 3	
Variable	Significant effect [Y/N]	Linear relation [Y/N]	Participant distribution [Y/N]	Provides competing alternative account to research hypothesis [Y/N]
Reading speed	Y	Y	N	N
Reading comprehension	Y	N		N
Subtitle length	Y	Y	N	N
Reading habit	Y	N		N
Subtitle reading habit	Y	N		N
Television viewing habit	Y	Y	N	N
Like to watch local soap operas	Y	N		N
Like to watch imported soap operas	Y	N		N
Prefer local television programmes with or without subtitles	N			N
Prefer imported television programmes with or without subtitles	Y	Y	N	N
L2 subtitle reading habit	Y	N		N
Like to read television subtitles	Y	N		N

Table 4.28 Summary of the findings for the additional variables. Each variable represents the possibility of an alternative hypothesis that could refute the research hypothesis that subtitle reading differs for L1 and L2.

Although conducted on a different scale, the three-year panel study by Koolstra *et al.* (1997) in which they measured television’s impact on children’s reading comprehension and decoding skills also examined the effects of television viewing, viewing frequency for entertainment and informational programmes, subtitle reading, book reading and reading attitude (although in this case the effects were measured for the children’s improvement in their reading and decoding skills of static text). For children in both age groups that were tested, reading comprehension was found to correlate negatively with the total amount of television viewing, the viewing frequency of entertainment programmes and subtitle reading (most correlations with subtitle reading were

not statistically significant) (Koolstra *et al.*, 1997:140). Furthermore, reading comprehension was found to correlate positively with the viewing frequency of informational programmes (though mostly non-significantly) (*ibid.*). No significant correlations were found for decoding skills and the television viewing measures (total amount of viewing and viewing frequency of entertainment and informational programmes), but decoding skills did correlate positively with subtitle reading, especially for the older children (*ibid.*). Lastly, Koolstra *et al.* (1997) found that, for both age groups tested, reading and comprehension skills correlated significantly and positively with book reading, reading concentration and reading attitude (Koolstra *et al.*, 1997:140).

Correlations of this nature between the different influencing variables were not of particular or immediate relevance to the current study, but might be considered for future research.

4.5 CONCLUSION

The aim of this chapter was to present and discuss the results of the analyses and all other empirical findings of this study in an attempt to explain the difference(s) found in the reading of L1 and L2 subtitles as measured by means of eye tracking. Confounding variables as gathered from the questionnaire and the reading of static text were also considered in order to explore possible alternative explanations for the patterns found in the reading of subtitles that might refute the hypothesis that subtitle reading differs for L1 and L2.

In the analysis of the eye-tracking data for subtitle reading it was found that there were no significant differences in the reading of Afrikaans subtitles. Participants in test groups TAE and TEA who viewed the Afrikaans subtitles in alternating order showed no effect for the order in which the Afrikaans subtitles were read, and when compared to the Afrikaans control group CAA, no indication of a possible learning effect for subtitle reading was found. Instead, CAA read slightly slower in the second half of the film. This difference was very small and, overall, the participants in these three groups read and processed the Afrikaans subtitles with the same ease. It was also found that the Afrikaans L1-speaking participants generally spent more time reading the subtitles, whether the subtitles were in Afrikaans or English, than did the English L1-speaking participants. More specifically, the Afrikaans L1-speaking participants in both the test groups (TEA, TAE) and the control group (CAA) spent more time overall reading the two-line subtitles than the English L1-speaking participants.

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

In the case of TAE where Afrikaans L1-speaking participants read English L2 subtitles in the second half of the film, the findings were more conclusive – the Afrikaans L1-speaking participants spent significantly more time reading the English subtitles than did the English participants (CEE) who were found to have read slightly faster during the second half of the film. This was the found for both one-line and two-line subtitles (cf. Tables 4.5 and 4.6, section 4.3.2.1 and Tables 4.8 and 4.9, section 4.3.3.1). English subtitles were therefore processed with more ease by L1 speakers than by L2 speakers during the second half of the film. Overall this was the most significant finding of this component of the study. This coincided with a strange pattern found for vertical movement and the number of shifts made between the subtitled area and the visuals above it – Afrikaans L1-speaking participants generally made the same, small number of vertical shifts which were much lower than the number of shifts made by the English L1-speaking participants, regardless of whether they read English or Afrikaans subtitles. The only exception was TAE who, when reading the English subtitles in the second half of the film, suddenly made much more vertical shifts than the other Afrikaans L1 speakers to such an extent that their viewing pattern resembled that of the English control group CEE.

Whereas there were no significant differences in the reading of Afrikaans subtitles, there were significant differences in the reading of English subtitles for TAE and CEE in the second half of the film. Possible explanations for this included the following:

- (1) That there is a difference for L1 and L2 subtitle reading.
- (2) That test group TAE perhaps consisted of slower readers and that their reading speed could have influenced their subtitle reading.
- (3) That the English L1-speaking participants perhaps read more, watched more television and read subtitles more regularly than the Afrikaans L1-speaking participants, which might cause them to read and process subtitles more easily.
- (4) That there was a learning effect for the English control group CEE which caused them to read the subtitles faster during the second half of the film, in other words that participants got used to reading the subtitles and then increased the speed with which they read and processed the subtitles, leaving the assumption that TAE read much slower when CEE in fact had an advantage. Coinciding with this is the possibility that the shift in language

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

caused TAE to be flustered with the change of language from the first half of the film to the second, leading to more and longer reading.

The **first possibility** constitutes the research hypothesis of this study. All other options were explored in order to find something that might offer an alternative explanation to refute or at least cast doubt on the research hypothesis.

The **second possibility** was ruled out based on the findings for participants' reading of static text. Contrary to what was thought, test group TAE displayed the fastest reading speed for the reading of both Afrikaans and English texts. Control group CAA read second fastest, followed by test group TAE's reading speed for Afrikaans and control group CEE's reading speed for English. Test group TEA had the slowest reading speed of all for their reading of English. Overall, reading speed did correlate significantly with the reading of subtitles, but although this effect was in the hypothesized direction, the pattern for participant distribution did not agree with the differences observed in the subtitle reading. Because all three criteria were not satisfied, reading speed was not found to provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2 (cf. Table 4.28, section 4.4.3.10). Furthermore, the correlation between the reading speeds for static text reading and subtitle reading was, despite being statistically significant, very low, with the degree of advantage for English subtitle reading being much lower (1.4%) than for Afrikaans (13.7%). When comparing the Afrikaans and English reading speeds in general, the Afrikaans static text was read faster than the English static text, but English and Afrikaans subtitles were read very similarly by the Afrikaans L1 speakers. One possible explanation for this could be that people are much less used to reading Afrikaans subtitles than English subtitles, and that their reading of Afrikaans static texts are facilitated by their continual exposure to other Afrikaans texts. The implication here is that people need more and continual exposure to L1 subtitle reading in order to improve the speed with which the subtitles are read. If people were to read subtitles faster without compromising their level of comprehension, they would spend less time in the subtitled area than was found for the current study and their attention would be distributed more optimally between the subtitled text and the rest of the visuals on-screen.

Participants' answers to the questionnaire were used to explore the **third possibility** listed above. ANOVAs on participants' reading habit, subtitle reading habit, television viewing habit, their liking of local and imported soap operas, their preference for subtitled television

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

programmes, their L2 subtitle reading habit and their general liking of subtitles did show significant interaction with their reading of subtitles (with the exception of one category), but the interaction did not go beyond having had a general effect. These variables passed the first two of the three criteria (statistically significant effect and linear relation) to various extents, but in none of the cases were all three criteria passed (cf. Table 4.28, section 4.4.3.10). Therefore none of these possible confounding variables offered an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2.

In order to explore the fourth possibility, the changes in reading from the first half of the film to the second were explored for all groups. In terms of reading time per word (ms), group CEE did indeed read faster in the second half (246.7 ms) than in the first (261.9 ms) whereas all other groups read slower (cf. Table 4.18, section 4.4.1.1). If there were a learning effect for group CEE because the subtitles were in the same language for the duration of the film, group CAA would also have read faster during the second half of the film, but this was not the case – group CAA read slower in the second half (281.5 ms) than in the first half (274.9 ms). In terms of the reading of English subtitles specifically, the difference between groups CEE and TAE for their reading of English subtitles during the second half was very big (246.7 ms for CEE, 291.4 ms for TAE), especially considering the fact that they read exactly the same subtitles with the same number of words. These values represent the fastest (CEE) and slowest (TAE) reading speeds per word for the entire participant population, but the fact that they were obtained from the same data set points to a difference for L1 and L2 subtitle reading. The possibility that the shift in language caused flustered reading was initially something to consider because TAE did take longer to read the English subtitles in the second half than they did for the Afrikaans subtitles in the first half – although this difference was very small (21.1 ms), it was the largest difference between the reading of the two halves for all the groups. However, when compared to the difference in reading caused by the shift in language for TEA (8.6 ms), it was clear that one cannot attribute the difference in subtitle reading to merely the shift in language, but rather to the language into which the shift occurred. The difference therefore still lay in the L1 and L2 reading of English subtitles.

In conclusion, the analysis failed to find support for confounding variables that might explain the differences in the reading of English subtitles. Therefore no alternative explanation was found to refute the research hypothesis that subtitle reading differs for L1 and L2. There might, of course, be other aspects that could have influenced participants' subtitle reading, but for the purpose of

Chapter 4: Analysis and interpretation of empirical findings for Afrikaans L1 speakers

the current study the hypothesis is therefore supported: it is more difficult to process English subtitles when read as L2 text than when read as L1 text.

The next chapter discusses the analysis and interpretation of the empirical findings for the Sesotho L1 speakers.

CHAPTER 5

Analysis and interpretation of empirical findings for Sesotho L1 speakers

5.1 INTRODUCTION

This chapter presents the results of the analyses of the eye-tracking and questionnaire data to identify and explain the difference(s) found in the reading of L1 and L2 subtitles by Sesotho L1 speakers. This is a replication of the study conducted with the Afrikaans L1 speakers, consequently all the procedural information is not repeated.

As in Chapter 4, the findings are presented and discussed in two main categories dealing with primary and secondary data respectively. The primary data comprises the eye-tracking data for the viewing of the subtitled material and are presented in terms of the analyses of both dependent and independent variables. The dependent and independent variables are the same as in Chapter 4 – key eye-tracking parameters indicating processing and vertical movement, and factors from the experimental design respectively. The secondary data comprises participants' responses to the questionnaire questions, representing possible confounding variables.

The hypotheses for this part of the study were the same as before:

H₀: There is no difference in subtitle reading in and between the different groups.

H_R: There are differences in subtitle reading for these groups and the differences are attributed to L1 and L2 subtitle reading.

H_A: There are differences in subtitle reading for these groups but the differences are attributed to other factors and/or influences, and not L1 and L2 reading.

As in Chapter 4, the primary data and findings refuted the null hypothesis that there is no difference in the reading of L1 and L2 subtitles. In addition to the differences found for L1 and L2 subtitle reading, significant differences were also found in the reading of L1 subtitles – the L1 Sesotho and L1 English subtitles were read significantly differently; a significance which was not found for the reading of L1 Afrikaans and L1 English subtitles. This constitutes a second and very important aspect of the primary findings, as it points to a greater issue at hand than L1

versus L2 reading, namely literacy. In terms of the difference in L1 and L2 subtitle reading, the secondary data was subsequently analysed in order to support the alternative hypothesis, but again the secondary findings did not provide an alternative explanation for the differences found in the eye-tracking data for subtitle reading. The research hypothesis was therefore supported in that the differences in subtitle reading are attributed to L1 and L2 reading. In terms of the difference in L1 subtitle reading, the secondary data was analysed in order to rule out the various variables as possible confounding variables and to support the notion that the differences in L1 subtitle reading are attributed to low literacy levels as a result of participants’ socioeconomic background and history.

5.2 PARTICIPANT DEMOGRAPHICS

A total of 44 Sesotho L1-speaking participants were initially tested for this part of the experiment. After excluding invalid data sets, 30 participants remained. These participants were distributed across three groups – test groups TSE and TES, and control group CSS. The gender and age distributions of the Sesotho participants can be seen in Table 5.1. Control group CEE (English L1-speakers) is the same group that was discussed in Chapter 4. Consequently the demographics of its participants are not repeated here.⁴²

Participant demographics					
Group	Gender		Age		
	Male	Female	Group average	Male average	Female average
TSE	5	5	21.2	21.2	21.3
TES	1	9	20.2	18	20.4
CSS	2	8	20.5	19	20.9
TOTAL	8	22	20.6	19.8	20.8

Table 5.1 The age and gender distribution of Sesotho L1-speaking participants across the test and control groups.

Ethnicity

All the participants involved in this component of the study were black. This was to be expected as they were all required to be Sesotho L1 speakers.

⁴² The English L1-speaking participants in control group CEE read and viewed the experimental materials once and the data was used in both Chapters 4 and 5 to compare to the English L2 reading of Afrikaans and Sesotho speakers.

Education

Participants all shared the basic educational level of Grade 12 schooling, but differed in their level of qualification and experience at university, ranging from first years to fourth years. Overall, 29 participants (97%) were undergraduate and 1 (3%) was postgraduate. They are therefore representative of different levels and capabilities of reading.

All participants were students who were enrolled for courses at the university at the time of data collection. The distribution across fields of study is as follows: Humanities and Behavioural Sciences, 13 participants (43.3%), Educational Sciences 2 participants (6.7%), Economic Sciences 5 participants (16.7%), Information Technology 3 participants (7.7%), and Sport Sciences 5 participants (12.8%), but not all participants answered the question. It may be argued that students from Humanities studying languages may have influenced the findings of the experiment – this was considered when signing up participants, but was not deemed a problem because these students are still representative of a part of the South African society that is currently viewing subtitled programming on public television.

When examining questionnaire questions on participants' parents' level of education, it is interesting to note that of all the participants, 37% of participants' fathers and 40% of their mothers had completed Grade 12, while a further 30% of mothers and fathers had completed tertiary education. However, 31.5% of participant's parents had only completed schooling up to grade 7. This is relevant because it indicates that participants come from households with varying levels of education – most of the participants are first generation students, meaning that they are more literate than previous generations in their communities, but generally this means that they are from backgrounds that do not stress literacy.

Vision

None of the participants wore prescription glasses or contact lenses – all 30 had normal, uncorrected vision.

Due to a lack of variance in the demographical detail of participants, the abovementioned data was not used for statistical analyses. It is merely reported here to describe the participants.

5.3 PRIMARY DATA: READING SUBTITLES

All data was recorded automatically using BeGaze 2.5 and exported by means of Excel for further analysis in Statistica. The same parameters were selected and analysed as in Chapter 4, and the same procedures were followed for statistical analyses.

The data collected for the Sesotho L1-speaking participants, however, revealed further underlying processing difficulties that were not present in the data for the Afrikaans L1-speaking participants, difficulties that can be attributed to socioeconomic and educational circumstances. Two of the most prominent of these circumstances are that the speakers of African languages are not afforded the opportunity to do some (or any) of their schooling in their home language (Pretorius & Mampuru, 2007:40), and the overall lack of reading materials in these languages:

In South Africa, only 27% of schools have school libraries. There are also relatively few children's books printed in the African languages, and many of them are translations from English. There are even fewer non-fiction books. Publishers are reluctant to print books in African languages for which there is not a market.

Even when African learners have the advantage of acquiring initial literacy in their home language, they do so in a print-poor environment. To use a rather crude analogy, this is akin to learning to play football without a ball.

(Pretorius & Mampuru, 2007:40)

Despite the poor availability of educational reading materials in learners' home languages, these educational materials are seemingly much more in demand than non-educational reading material. Pretorius and Mampuru (2007:41) state that 95% of all books sold in Africa are educational books, and that "reading for pleasure is not common." For speakers of African languages reading in their home languages therefore occurs mainly, and to a very limited extent, within the classroom environment and very little outside of it. The overall result of these (and many other circumstances) is the general lack of a reading culture in most of the African language-speaking communities, which is, in turn, reflected in very low literacy levels. This has been found for many (if not most) of the township schools in South Africa (Pretorius & Machet, 2004; Pretorius & Ribbens, 2005; Pretorius & Mampuru, 2007; Pretorius & Currin, 2010). However, low literacy levels are not only restricted to children. Pretorius (2000:36) found that more than fifty percent of the 1200 Psychology and Sociology undergraduate students studying at the University of South Africa (Unisa) and whose reading ability were tested, read at a comprehension level of 50% or lower. Furthermore, a small sample of these students was found

to read at a reading speed of 96 wpm. According to Pretorius this is “far below the recommended minimum of at least 150 wpm for L2 readers” (*ibid.*).

This had to be taken into account when interpreting the data, as all (or most) of the findings could be attributed to a general lack of reading experience and thus reading skills in their L1 (Sesotho), insufficient reading capabilities for the reading of L2 English, and the overall lack of literacy.

As in Chapter 4, results were analysed in terms of the two halves of the film, the language of the respective halves and the number of lines in the subtitle. For the purpose of the discussion, the findings are organized based on the number of lines in the subtitle and are discussed accordingly.

5.3.1 Difference between the reading of 1-line and 2-line subtitles

Results are discussed in terms of one-line and two-line subtitles because of the well-documented differences between how they are read. To combine these two measures would add an additional, unknown variable to the results which one would not be able to account for.

Findings for the processing of one-line and two-line subtitles in the current experiment coincide with the findings of previous research on the topic. All groups spent proportionally more time reading two-line subtitles than one-line subtitles as was indicated by dwell time, fixation time, and fixation count, the three parameters used to measure absorption. This agrees with the findings of previous studies (Praet *et al.*, 1990; d’Ydewalle *et al.*, 1991; De Bruycker & d’Ydewalle, 2003; d’Ydewalle & De Bruycker, 2007). However, the overall values for time spent reading two-line and one-line subtitles separately and overall (one-line and two-line subtitles together) were considerably higher than that found in a comparable study by d’Ydewalle and De Bruycker in 2007, and were also higher than what was found for the Afrikaans L1 speakers in Chapter 4.

Percentage time spent reading one-line and two-line subtitles			
	D'Ydewalle & De Bruycker (2007:200)	Current study: Sesotho Speakers (2011)	Current study: Afrikaans Speakers (2011)
One-line	37%	70%	58%
Two line	45%	79%	70%
Overall	41%	76%	67%

Table 5.2 Comparison of findings for overall time spent reading one-line and two-line subtitles. These values were calculated by considering dwell time as a percentage of the total visible time of the respective one-line and two-line subtitles, regardless of language.

The study conducted by d'Ydewalle and De Bruycker (2007) can be used as a comparative measure due to the similar natures of the experiments. Both experiments based the subtitle presentation on the six-second rule and in both cases the participants had no knowledge of the foreign language of the film (they showed a Swedish film with Dutch subtitles to Dutch participants), thus forcing them to read the subtitles. Participants were unbiased toward the purpose of both experiments and did not know they were going to read subtitles. In terms of the calculation for time spent in the subtitle, this value was calculated in both studies based on the total time spent in the subtitled area (fixations and saccades) as a percentage of the total visible time of the respective subtitles.⁴³

Information load needs to be discussed here briefly. Upon analysis of the individual subtitles for the current study, the average presentation rate of one-line and two-line subtitles were found to be 159 and 197 wpm respectively for Sesotho and English subtitles combined. The averages for Sesotho subtitles were 178 and 220 wpm for one-line and two-line subtitles, while English subtitles were displayed at 135 and 175 wpm (cf. section 5.4.1.1).⁴⁴ When compared to the Afrikaans data in Chapter 4 (144 and 175 wpm for one-line and two-line subtitles, cf. section 4.4.1.1) and the reading speeds of the English subtitles mentioned here, a higher demand was seemingly placed on the Sesotho speakers by presenting the Sesotho subtitles at much higher reading speeds. However, the load was effectively not much higher than for either the Afrikaans or English subtitles – the average word in Sesotho is almost a full character shorter than in both

⁴³ This same method of calculation was not necessarily applied in all the other studies referred to here.

⁴⁴ These values were calculated by dividing the number of words in the individual subtitles by the visible time of the respective subtitles and calculating the averages. For these calculations, the average word in Sesotho was taken to consist of 3.9 characters, while the average English and Afrikaans words were taken to consist of 4.7 and 4.8 characters respectively. This was based on corpus analyses of the BNC (British National Corpus), the PSC (Pretoria Sotho Corpus) and the ATK (Afrikaanse Taalkommissie Korpus or “Afrikaans Language Commission Corpus”).

Afrikaans and English, which might affect the calculation of reading speed, but actually equalises the processing load to some extent. Similar detailed values are not stated by d'Ydewalle and De Bruycker (2007) and thus there is no way of comparing the exact reading speeds of subtitles used in the two studies. The comparative values of the time spent in one-line and two-line subtitles (Table 5.2) can therefore only be considered as estimations, but should not be dismissed entirely.

De Brucker and d'Ydewalle (2003) reported the same values as d'Ydewalle and De Bruycker (2007), with 37% of time spent in one-line subtitles, 45% in two-line subtitles, and 41% overall. Praet *et al.* (1990) found slightly lower values – 23.93% for the reading of one-line subtitles and 37.41% for two-line subtitles. For subtitles presented to children in Grades 2, 4 and 6 according to the six-second rule, Koolstra *et al.* (1999:416) found that participants spent 36% of the presentation time reading one-line subtitles, 46% reading two-line subtitles, and 41% overall. d'Ydewalle *et al.* (1991) found that American participants spent 16.37% of the time in one-line and 21.87% in two-line subtitles, as opposed to Dutch participants who spent 16.09% and 24.39% reading one-line and two-line subtitles respectively. However, this experiment was slightly different in that it presented the two groups with different films, both with same-language (intralingual) subtitles.⁴⁵ The abovementioned studies also used a maximum of 32 characters per line for their application of the six-second rule.

The high values found for the current study are very worrisome, as participants spent almost all of their viewing time reading the subtitles and hardly had time to look at the rest of the screen. This is not the ideal for the presentation of subtitles – subtitles are not supposed to detract from the overall viewing of a programme. One possible explanation for the difference in values for d'Ydewalle and De Bruycker (2007) and the current study is that, in their case, the subtitles were shown to Dutch participants, who are generally more exposed to the reading of subtitles. For Sesotho participants reading static text in Sesotho is already an uncommon occurrence, and reading subtitles in Sesotho is thus completely foreign and unknown to them. And although assumptions about the effect of participants' familiarity with subtitles should be made with caution as there are different perceptions as to what these effects are and how they are to be

⁴⁵ What is interesting about this finding is that the Dutch participants from Belgium, who are generally thought to read more subtitles on a day-to-day basis, spent more time reading two-line subtitles than the American participants, which raises the question as to whether one can ever 'get used to' reading subtitles.

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

measured, one cannot ignore the impact thereof on the Sesotho speakers in this study.⁴⁶ What is even more worrisome is that, in the case of Koolstra *et al.* (1999), the values were measured for children in primary school whereas in the current study they were measured for university students – the university students spent more time reading the subtitles. Values were also high when examining the difference for Sesotho, Afrikaans and English subtitles, as can be seen in Table 5.3.

Percentage time spent reading Sesotho, Afrikaans and English one-line and two-line subtitles					
	Sesotho subtitles	Afrikaans subtitles	English subtitles read by L1 speakers	English subtitles read by L2 speakers (Sesotho)	English subtitles read by L2 speakers (Afrikaans)
One-line	79 %	62 %	51 %	63 %	56 %
Two line	86 %	71 %	66 %	76 %	72 %
Overall	83 %	68 %	62 %	74 %	67 %

Table 5.3 Comparison of findings for time spent reading Sesotho, Afrikaans and English one-line and two-line subtitles. These values were calculated by considering dwell time as a percentage of the total visible time of the one-line and two-line subtitles per language group.

In terms of one-line and two-line subtitles, as well as combined, more time was spent reading Sesotho subtitles than either Afrikaans or English subtitles as read by L1 speakers. The Sesotho speakers also spent more time reading the L2 English subtitles than the Afrikaans speakers. What is clear from Table 5.3 is that the Sesotho participants experienced the Sesotho subtitles as completely foreign and did not have the necessary reading skills to read the Sesotho subtitled text and view the rest of the visuals simultaneously, whereas they were much more comfortable reading the English subtitles. Yet it is still obvious that they read the English subtitles, in their second language, much slower than the Afrikaans participants. This corresponds to what is known about overall literacy levels in township schools (cf. section 5.3).

In order to calculate the different groups’ allocation of attention, three measures were used: the total visible time of the subtitles as a percentage of the duration of the video (starting when the first subtitle appeared and the last subtitle disappeared), the total dwell time of participants within the areas of interest (the subtitles) as a percentage of the duration of the video (starting when the first subtitle appeared and the last subtitle disappeared), and participants’ dwell time

⁴⁶ See also the comments in the footnotes to section 6.3.3 of the current study on the matter of familiarity.

within the areas of interest as a percentage of the visible time of the subtitles. These values can be seen in Table 5.4 below.

Percentage time spent reading subtitles in terms of film duration						
Group	VT of subtitles [sec.]	Film duration - subtitles only [sec.]	VT as % of total film duration - subtitles only	DT in subtitles [sec.]	DT as % of total film duration - subtitles only	DT as % of VT
CSS	2054.0	2906.0	70.7	1744.7	60.0	84.9
TSE	2012.8	2906.0	69.3	1536.6	52.9	76.3
TES	2034.4	2906.0	70.0	1613.3	55.5	79.3
CEE	1796.8	2615.4	68.7	1113.0	42.6	61.9

Table 5.4 Calculation of the time spent reading subtitles based on the visible time (VT) of the subtitles and participants' dwell time (DT) in the subtitles, using the duration of the film (starting when the first subtitle appeared and ending when the last subtitle disappeared).

In terms of vertical movement and interaction between the subtitled area at the bottom of the screen and the rest of the visuals above it, the most significant finding was that the English L1-speaking participants generally made significantly more vertical movements in the form of glances and revisits than did the Sesotho L1-speaking participants.⁴⁷ This was found for both one-line and two-line subtitles for the duration of the film. The difference in reading can be ascribed to English L1 versus English L2 reading and also to the L1 of the respective participants (Sesotho or English).

The findings for vertical movement cannot be compared to previous studies in detail, as no other study measured the difference between the reading of two different subtitled languages when the soundtrack was in a foreign language and not the same as either of the two subtitled languages. The studies that are comparable to some extent (De Bruycker & d'Ydewalle, 2003; d'Ydewalle & De Bruycker, 2007) measured the difference in reading standard (interlingual – foreign language soundtrack, native language subtitles) and reversed (native language soundtrack, foreign language subtitles) subtitling. Both found more vertical movements for standard (0.49) than reversed (0.24) subtitles, which one might interpret as meaning that, if the subtitled language is understood and read for comprehension, more vertical movements will be made than if the language to be read is not understood, but this cannot be said with absolute certainty.

⁴⁷ As was mentioned in Chapter 3, both glances and revisits relate to a subtitle being visited and then revisited by making subsequent glances back to the subtitled area after having visited it for the first time.

As is discussed in the sections to follow, significant differences were found in the reading of Sesotho and English subtitles. Significant differences were also found in the reading of English subtitles as read by Sesotho L1-speaking participants (TES, TSE) and English L1-speaking participants (CEE). Significant differences were found during the first and second halves of the film to varying extent.

5.3.2 One-line subtitles

One-line subtitles were analysed in terms of absorption and vertical movement based on the language and the two halves of the film.

5.3.2.1 Absorption

In terms of absorption it was found that the Sesotho L1 speakers in the test and control groups read the Sesotho one-line subtitles almost the same for the duration of the film. There were no statistically significant differences in the means, in other words participants in both the test and control groups processed the Sesotho one-line subtitles the same. This was indicated by dwell time total, fixation time total and fixation count. For English subtitles the results differ slightly. Throughout the entire film there were statistically significant differences in the means of Sesotho L1 speakers and English L1 speakers reading English one-line subtitles, as well as for the reading of Sesotho and English subtitles in general – the Sesotho L1 speakers (TES and TSE) read the English subtitles slower than their English L1-speaking counterparts (CEE), and throughout the film the Sesotho subtitles were read significantly slower than the English subtitles. It was also found that the Sesotho L1 speakers generally spent more time reading the subtitles than the English L1 speakers, regardless of whether the subtitles they were reading were in Sesotho or English.

These findings differ slightly from what was reported for the reading of Afrikaans and English one-line subtitles in Chapter 4. Whereas the Sesotho speakers in both test groups TSE and TES consistently read the English one-line subtitles significantly slower than the English L1 speakers throughout the entire film, a significant difference was only found for one Afrikaans test group (TAE) and only during the second half of the film. Furthermore, the difference between the reading of Sesotho and English one-line subtitles was much greater than the difference between the reading of Afrikaans and English subtitles, indicating that the Afrikaans speakers are much

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

more used to reading in both their L1 and English as their L2. L1 reading skill is the key differentiating factor here – Afrikaans speakers generally do much more L1 reading than Sesotho speakers, for whom very little Sesotho reading material is available. As has been established in numerous studies, limited availability of reading materials is the leading reason for the weak reading skills and overall low literacy levels of students’ coming from African language-speaking communities and of the communities in general (Pretorius & Machet, 2004; Pretorius & Ribbens, 2005; Pretorius & Mampuru, 2007; Pretorius & Currin, 2010). For learners from these communities who pursue tertiary qualifications, this also results in weak academic performance because they often cannot cope with the vast amounts of required reading at tertiary level.

One-line subtitles: First half								
Cond	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		Means	Std.Dev.	Means	Std.Dev.	Means	Std.Dev.	
C	S	2207.502	580.998	1951.251	544.280	8.523	2.182	130
C	E	1468.238	468.940	1272.838	423.255	6.533	1.861	90
T	S	1893.937	700.303	2185.415	834.495	7.731	2.734	130
T	E	1693.473	530.965	1472.795	490.895	7.560	2.119	100

Table 5.5 Means and standard deviations of the parameters indicating the processing difficulty (absorption) of one-line subtitles during the first half of the film.

One-line subtitles: Second half								
Cond	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		Means	Std.Dev.	Means	Std.Dev.	Means	Std.Dev.	
C	S	2053.307	501.080	1805.731	459.040	8.454	2.117	130
C	E	1222.057	451.082	1056.799	413.703	5.500	1.664	90
T	S	2044.043	483.186	1813.032	473.343	8.185	1.850	130
T	E	1616.781	581.999	2120.318	901.093	6.840	2.135	100

Table 5.6 Means and standard deviations of the parameters indicating the processing difficulty (absorption) of one-line subtitles during the second half of the film.

Dwell time total

In the first half of the film statistically significant interaction was found between language and condition for dwell time ($F(1, 446)=22.993, p<0.001$), with a significant main effect for language ($F(1, 446)=69.945, p<0.001$). In other words, the Sesotho and English subtitles were read differently – overall the English subtitles were read 464 ms faster than the Sesotho subtitles ($t = 8.06, p<0.01$) and had a medium effect size in terms of Cohen’s practical significance ($d =$

0,70). As can be seen in Table 5.5, the Sesotho L1 speakers generally read the subtitles slower than the English L1 speakers. The Sesotho L1 speakers in test group TES, who read English subtitles during the first half of the film, read the English subtitles faster than the Sesotho L1 speakers in both test group TSE (difference = 200 ms, $t = 2.38$, $p < 0.05$) and control group CSS (difference = 514 ms, $t = 6.90$, $p < 0.01$) who read Sesotho subtitles during the first half of the film, and had small ($d = 0,28$) and large ($d = 0,88$) effect sizes respectively. Participants in control group CEE were found to read the subtitles the fastest of all the groups ($M = 1468.238$, $SD = 468.940$), 225 ms faster than test group TES ($t = 3.08$, $p < 0.01$). This difference had a small effect size ($d = 0,42$).

In the second half of the film there was also statistically significant interaction between language and condition ($F(1, 446) = 17.473$, $p < 0.001$) with a significant main effect for language ($F(1, 446) = 169.56$, $p < 0.001$), which means that, as in the first half of the film, the Sesotho and English subtitles were read differently – the English subtitles were read 619 ms faster than the Sesotho subtitles ($t = 12.45$, $p < 0.01$) and had a large effect size in terms of Cohen's practical significance ($d = 1,11$). The Sesotho L1-speaking participants who read Sesotho subtitles during the second half of the film (test group TES and control group CSS) read the subtitles very similarly with a difference of only 9 ms ($t = 0.15$, $p > 0.05$), whereas the Sesotho L1-speaking participants in test group TSE, who read English subtitles during the second half of the film, read much faster than the slowest of the two, test group TES (difference = 427 ms, $t = -6.08$, $p < 0.01$) with a medium effect size ($d = 0,73$). As was found in the first half of the film, control group CEE read the fastest of all the groups ($M = 1222.057$, $SD = 451.082$), 395 ms faster than TSE ($t = 5.18$, $p < 0.01$). This difference had a medium effect size ($d = 0,68$).

Fixation time total

In the first half of the film there was no significant interaction between language and condition for fixation time ($F(1, 446) = 0.08520$, $p > 0.05$). There was, however, a significant main effect for language ($F(1, 446) = 140.88$, $p < 0.01$). This indicates that the Sesotho and English subtitles were read differently during the first half of the film – in terms of fixation duration the English subtitles were read 690 ms faster than the Sesotho subtitles ($t = 11.63$, $p < 0.01$) and had a large effect size in terms of Cohen's practical significance ($d = 0,96$). Control group CEE read the English subtitles 200 ms faster than test group TES who read English subtitles during the first half of the film ($t = -2.99$, $p < 0.01$), while control group CSS read the Sesotho subtitles 234 ms

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

faster than test group TSE who read Sesotho subtitles during the first half of the film ($t = -2.68$, $p < 0.01$). These differences both had small effect sizes ($d = 0,41$ and $d = 0,28$ respectively). As with dwell time, the Sesotho L1 speakers in test group TES, who read English subtitles during the first half of the film, read the English subtitles faster than the Sesotho L1 speakers in both test group TSE (difference = 713 ms, $t = 7.59$, $p < 0.01$) and control group CSS (difference = 478 ms, $t = 6.89$, $p < 0.01$) who read Sesotho subtitles during the first half of the film. These differences both had large effect sizes ($d = 0,85$ and $d = 0,88$ respectively).

In the second half of the film statistically significant interaction was found between language and condition for fixation time ($F(1, 446) = 89.868$, $p < 0.01$), with significant main effects for both language ($F(1, 446) = 15.713$, $p < 0.01$) and condition ($F(1, 446) = 92.370$, $p < 0.01$). This indicates that the Sesotho and English subtitles were read differently and also that the English subtitles, specifically, were read differently by the test and control groups (TSE and CEE) who read English subtitles during the second half of the film. The English subtitles were read 193 ms faster than the Sesotho subtitles ($t = 2.98$, $p < 0.01$) and had a small effect size in terms of Cohen's practical significance ($d = 0,22$). When compared to the values found for subtitle reading during the first half of the film this difference is small, but it can be explained by the fact that there was a very big difference in fixation time for the reading of English subtitles – the fixations made by test group TSE, who read the subtitles as L2 text, were 1064 ms longer than for control group CEE, who read the same subtitles as L1 text ($t = -10.26$, $p < 0.01$) and had a large effect size ($d = 1,18$). In addition, as with dwell time, the Sesotho L1-speaking participants who read Sesotho subtitles during the second half of the film (test group TES and control group CSS) read the subtitles very similarly with a difference of only 7 ms ($t = -0.13$, $p > 0.05$). In contrast to what was found for dwell time, however, test group TSE, who read English subtitles during the second half of the film, did not read the subtitles faster than the groups who read Sesotho subtitles (CSS and TES) – in terms of fixation time, test group TSE read the subtitles the slowest of all the groups during the second half of the film, 307 ms slower than TES ($t = -3.34$, $p < 0.01$). This difference had a small effect size ($d = 0,34$).

Fixation count

In terms of fixation count statistically significant interaction was found between language and condition during the first half of the film ($F(1, 446) = 17.331$, $p < 0.01$) with a significant main effect for language ($F(1, 446) = 24.450$, $p < 0.01$). This indicates that, as was found for dwell time

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

and fixation time, Sesotho subtitles were read differently than English subtitles, with 1.05 more fixations being made in the Sesotho subtitles ($t = 4.74$, $p < 0.01$). This difference had a small effect size in terms of Cohen's practical significance ($d = 0,42$). The Sesotho L1 speakers in control group CSS, who read Sesotho subtitles during the first half of the film, made 0.79 more fixations than the Sesotho L1 speakers in test group TSE who also read Sesotho subtitles ($t = 2.58$, $p < 0.05$), and 0.96 more fixations than test group TES, who read English subtitles during the first half of the film ($t = 3.36$, $p < 0.01$). These differences both had small effect sizes ($d = 0,29$ and $d = 0,44$ respectively). Control group CEE, the English L1 speakers, made the smallest number of fixations ($M = 6.5$, $SD = 1.86$), 1.03 fixations fewer than test group TES who also read English subtitles during the first half of the film ($t = -3.53$, $p < 0.01$). This difference had a medium effect size ($d = 0,48$).

In the second half of the film there was also statistically significant interaction between language and condition ($F(1, 446) = 18.424$, $p < 0.01$) with a significant main effect for language ($F(1, 446) = 131.45$, $p < 0.01$), indicating that Sesotho and English subtitles were read differently – on average 2.11 more fixations were made during Sesotho subtitle reading than when reading English subtitles ($t = 11.03$, $p < 0.01$). This difference had a large effect size in terms of Cohen's practical significance ($d = 1,04$). The Sesotho L1 speakers in control group CSS, who read Sesotho subtitles during the second half of the film, made 0.27 more fixations than the Sesotho L1 speakers in both test group TES ($t = 1.09$, $p > 0.05$), who also read Sesotho subtitles, and 1.61 more fixations than the Sesotho L1 speakers in test group TSE ($t = 5.71$, $p < 0.01$), who read English subtitles. This difference of 1.61 fixations had a large effect size ($d = 0,76$). However, participants in control group CEE made the smallest number of fixations of all the groups ($M = 5.5$, $SD = 1.64$), 1.34 fixations fewer than test group TSE ($t = -4.79$, $p < 0.01$). This difference had a medium effect size ($d = 0,63$).

All three parameters used to measure absorption therefore indicate significant differences in the reading of Sesotho and English subtitles in general, and that test groups TES and TSE, who read English L2 subtitles during the first and second halves of the film respectively, read the English subtitles faster than subtitles in their L1, Sesotho. Furthermore, all three parameters indicate that English subtitles were read slower when read as L2 text by test groups TES and TSE than when read as L1 text by control group CEE.

5.3.2.2 Vertical movement

There were no statistically significant differences in the means of glances and revisitors counts for Sesotho L1 speakers in the test and control groups reading one-line subtitles. All Sesotho L1 participants therefore read the same in terms of the vertical movements made between the subtitled area and the rest of the screen. Furthermore, it was found that the Sesotho L1 speakers in general made fewer jumps between the subtitled area and the rest of the visuals on the screen than the English L1 speakers when reading one-line subtitles. When compared to Chapter 4 these findings agree with the findings for Afrikaans and English subtitle reading by Afrikaans L1 speakers – the Afrikaans L1 speakers also generally made fewer jumps between the subtitled area and the rest of the screen than the English L1 speakers.

In the first half of the film, the Sesotho L1-speaking participants in groups TSE and CSS displayed similar reading patterns for Sesotho subtitle reading, their glances and revisitors count values almost the same. Compared to these values, the Sesotho L1-speaking participants in test group TES, who read English subtitles during the first half of the film, made significantly more glances and revisits, almost resembling the viewing pattern of the English L1-speaking participants in control group CEE. In the first half of the film there was therefore a large difference in the reading and viewing of Sesotho and English subtitles. This pattern was repeated in the second half of the film, with the Sesotho L1-speaking participants in groups TES and CSS again making fewer glances and revisits for their reading of the Sesotho subtitles than the Sesotho L1-speaking participants in test group TSE and the English L1-speaking participants in control group CEE for their reading of English subtitles.

These findings differ slightly from what was reported for the reading of Afrikaans and English one-line subtitles in Chapter 4. Firstly, whereas the Sesotho and English subtitles were read distinctly differently throughout the entire film (much fewer jumps were made between the subtitled area and the rest of the screen by the groups reading the Sesotho subtitles than by the groups reading the English subtitles in both halves), the Afrikaans data indicated that the Afrikaans speakers were grouped together in the first half of the film (whether they read Afrikaans or English subtitles), making much fewer jumps between the subtitled area and the rest of the screen than the English L1-speakers in control group CEE. In the second half of the film the Afrikaans data agree more with the Sesotho data, with the test group reading English subtitles during the second half of the film (TAE) making more jumps between the subtitled area

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

and the rest of the screen than the groups reading Afrikaans, nearly reflecting the viewing pattern of the English L1 speakers.

Secondly, whereas the Afrikaans test group TEA (who changed from reading English subtitles to Afrikaans subtitles) displayed nearly the same viewing pattern for the first and second halves of the film despite the change in language, the Sesotho test group TES (who changed from reading English subtitles to Sesotho subtitles) showed a significant decrease in the number of jumps made between the subtitled area and the rest of the screen, clearly indicating a difference in the reading of English and Sesotho subtitles but not Afrikaans and English subtitles. Similarly, the Sesotho test group TSE (who changed from reading Sesotho subtitles to English subtitles) showed a significant increase in the number of jumps made between the subtitled area and the rest of the screen. The difference between the reading of English and Afrikaans subtitles was only evident and significant for the Afrikaans participants in test group TAE, who made significantly more jumps between the subtitled area and the rest of the screen for English subtitle reading during the second half of the film.

Thirdly, for the groups who read English subtitles during the second half of the film (TAE and TSE), the difference between L1 and L2 English reading was more evident for the Sesotho speakers than the Afrikaans speakers.

As was found for absorption, the overall findings indicate that the Sesotho speakers were more comfortable reading the English two-line subtitles than the Sesotho two-line subtitles, with an almost more natural viewing pattern for the reading of English subtitles in terms of jumping between the subtitled area and the rest of the screen. However, the Sesotho speakers' reading of the L2 English subtitles was still not optimal – they needed more time in order to read the subtitles more easily, which would be reflected, in this case, in a more regular viewing pattering and the equal distribution of attention between the subtitled area and the rest of the visuals above it.

One-line subtitles											
		First half					Second half				
Cond	Lang	Glances count		Revisitors count		N	Glances count		Revisitors count		N
		Means	Std.Dev.	Means	Std.Dev.		Means	Std.Dev.	Means	Std.Dev.	
C	S	1.20	0.40	0.20	0.40	130	1.25	0.45	0.24	0.43	130
C	E	1.61	0.65	0.53	0.50	90	1.53	0.62	0.47	0.50	90
T	S	1.15	0.43	0.18	0.38	130	1.18	0.38	0.18	0.38	130
T	E	1.53	0.59	0.49	0.50	100	1.38	0.60	0.34	0.48	100

Table 5.7 Means and standard deviations of the parameters indicating the vertical movements made when reading one-line subtitles for the first and second halves of the film.

Glances count

In the first half of the film, the interaction between language and condition was not statistically significant ($F(1, 446)=0.07743, p>0.05$), meaning that the respective test and control groups read the Sesotho and English subtitles quite similarly in terms of the number of glances made to the subtitles. There was, however, a significant main effect for language ($F(1, 446)=65.827, p<0.01$). In other words, the number of glances made to the subtitles differed significantly when reading Sesotho and English subtitles during the first half of the film – on average, 0.4 more glances were made when reading English subtitles than when reading Sesotho subtitles ($t = -8.08, p<0.01$). This difference is significant in terms of the scale of values and had a medium effect size in terms of Cohen’s practical significance ($d = 0,64$). There were no statistically significant findings for the reading of Sesotho one-line subtitles.

Results were similar for the second half of the film – no statistically significant interaction was found between language and condition ($F(1, 446)=0.75156, p>0.05$), indicating that the Sesotho and English subtitles were read similarly by the respective groups. And as was found in the first half, there was a significant main effect for language ($F(1, 446)=25.538, p<0.01$) – on average, 0.24 more glances were made when reading English subtitles than when reading Sesotho subtitles ($t = -4.95, p<0.01$). This difference is significant in terms of the scale of values and had a small effect size in terms of Cohen’s practical significance ($d = 0,39$). The pattern for subtitle viewing in terms of the number of glances made to the subtitles during the second half of the film closely resembles that of the first half of the film, with slightly fewer glances made for English subtitle reading only (these differences were not statistically significant). What is interesting, however, is that test group TSE showed an increase in the number of glances made from the first half of the film (Sesotho subtitles) to the second (English subtitles) – in terms of the scale of values, this difference of 0.23 glances was statistically significant ($t = -3.43, p<0.01$)

and had a small effect size ($d = 0,39$). Furthermore, test group TES showed a decrease in the number of glances made from the first half of the film (English subtitles) to the second (Sesotho subtitles) – in terms of the scale of values, this difference of 0.35 glances was statistically significant ($t = 5.46$, $p < 0.01$) and had a medium effect size ($d = 0,59$). By making more glances to the subtitles during the reading of English subtitles in the respective halves of the film, both test groups TES and TSE almost resemble the viewing pattern of the English L1 speakers in control group CEE in terms of interaction with the subtitles and the rest of the visuals on the screen. There were no statistically significant findings for the reading of Sesotho one-line subtitles.

Revisitors count

No statistically significant interaction was found between language and condition for revisitors count in the first half of the film ($F(1, 446) = 0.5756$, $p > 0.01$). There was, however, a significant main effect for language ($F(1, 446) = 58.612$, $p < 0.01$). This means that the number of revisits made to the subtitled area differed significantly for the reading of Sesotho and English subtitles – on average, 0.32 more revisits were made to the subtitled area during English subtitle reading than for Sesotho subtitle reading ($t = -7.65$, $p < 0.01$). This is a significant difference in terms of the scale of values and had a medium effect size in terms of Cohen's practical significance ($d = 0,64$). There were no statistically significant findings for the reading of Sesotho one-line subtitles.

The second half showed no statistically significant interactions between language and condition either ($F(1, 446) = 0.59323$, $p > 0.05$), but as in the first half of the film there was a significant main effect for language ($F(1, 446) = 21.413$, $p < 0.01$). This again indicates that the number of revisits made to the subtitled area differed significantly for the reading of Sesotho and English subtitles – on average, 0.19 more revisits were made to the subtitled area during English subtitle reading than for Sesotho subtitle reading ($t = -4.54$, $p < 0.01$). This is a significant difference in terms of the scale of values and had a medium effect size in terms of Cohen's practical significance ($d = 0,47$). The pattern for subtitle viewing in terms of the number of revisits made to the subtitled area during the second half of the film closely resembles that of the first half of the film, with slightly fewer revisits made during English subtitle reading only (these differences were not statistically significant). What is interesting, however, is that test group TSE showed an increase in the number of revisits made from the first half of the film (Sesotho subtitles) to the

second (English subtitles) – in terms of the scale of values, this difference of 0.16 revisits was statistically significant ($t = -2.88$, $p < 0.01$) and had a small effect size ($d = 0,34$). Furthermore, test group TES showed a decrease in the number of revisits made from the first half of the film (English subtitles) to the second (Sesotho subtitles) – in terms of the scale of values, this difference of 0.31 revisits was statistically significant ($t = 5.36$, $p < 0.01$) and had a medium effect size ($d = 0,62$). By making more revisits to the subtitled area during the reading of English subtitles in the respective halves of the film, both test groups TES and TSE almost resemble the viewing pattern of the English L1 speakers in control group CEE in terms of interaction with the subtitles and the rest of the visuals on the screen. There were no statistically significant findings for the reading of Sesotho one-line subtitles.

Both parameters used to measure vertical movement indicate significant differences in the reading of Sesotho and English one-line subtitles – there was significantly less vertical movement between the subtitles and the rest of the screen for Sesotho subtitle reading than for English subtitle reading. Furthermore, the Sesotho L1 speakers made fewer vertical movements than the English L1 speakers, regardless of whether they were reading Sesotho or English subtitles. There were no statistically significant findings for the reading of Sesotho one-line subtitles.

5.3.3 Two-line subtitles

Two-line subtitles were analysed in terms of absorption and vertical movement based on the language and the two halves of the film.

5.3.3.1 Absorption

Dwell time total and fixation count indicated that, in general, the Sesotho L1 speakers in the test and control groups read the Sesotho two-line subtitles almost the same for the duration of the film. The most significant findings, however, were not for the reading of Sesotho two-line subtitles, but for the reading of Sesotho and English subtitles, and for reading the English subtitles as L2 and L1 text. During the first half of the film the Sesotho L1-speaking participants spent significantly more time reading the English subtitles than the English L1-speaking participants. During the second half of the film this was found for all parameters except fixation time total, which indicated that the English subtitles were read nearly identically by the Sesotho

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

L1 and English L1 speakers. More general findings include that the Sesotho L1 speakers generally spent more time reading two-line subtitles than their English L1-speaking counterparts.

These findings differ slightly from what was reported for the reading of Afrikaans and English two-line subtitles in Chapter 4. Whereas the Sesotho speakers in both test groups TSE and TES consistently read the English two-line subtitles significantly slower than the English L1 speakers throughout the entire film, a significant difference was only found for one Afrikaans test group (TAE) and only during the second half of the film. Furthermore, the difference between the reading of Sesotho and English two-line subtitles was much greater than the difference between the reading of Afrikaans and English subtitles. This was also found for the reading of one-line subtitles. L1 reading skill is the key differentiating factor here – Afrikaans speakers generally do much more L1 reading than Sesotho speakers, for whom very little Sesotho reading material is available.

Two-line subtitles: First half								
Cond	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		Means	Std.Dev.	Means	Std.Dev.	Means	Std.Dev.	
C	S	3429.420	668.172	2986.768	605.873	13.400	3.331	160
C	E	2568.123	811.411	2184.359	715.957	11.043	3.316	162
T	S	3156.061	847.359	2363.004	908.726	12.994	3.315	160
T	E	2866.420	836.289	2459.153	753.647	12.478	3.479	180

Table 5.8 Means and standard deviations of the parameters indicating the processing difficulty (absorption) of two-line subtitles during the first half of the film.

Two-line subtitles: Second half								
Cond	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		Means	Std.Dev.	Means	Std.Dev.	Means	Std.Dev.	
C	S	3224.488	993.096	2802.669	878.331	12.910	4.344	200
C	E	2527.088	727.389	2126.716	670.690	11.228	3.004	180
T	S	3311.516	828.307	2897.525	745.027	13.570	3.719	200
T	E	3118.842	804.209	2154.658	867.588	13.310	3.237	200

Table 5.9 Means and standard deviations of the parameters indicating the processing difficulty (absorption) of two-line subtitles during the second half of the film.

Dwell time total

In the first half of the film statistically significant interaction was found between language and condition for dwell time ($F(1, 658)=21.317, p<0.01$), with a significant main effect for language ($F(1, 446)=86.408, p<0.001$). In other words, the Sesotho and English subtitles were read differently – overall the English subtitles were read 568 ms faster than the Sesotho subtitles ($t = 9.04, p<0.01$) and had a medium effect size in terms of Cohen’s practical significance ($d = 0,68$). As can be seen in Table 5.8, the Sesotho L1 speakers generally read the subtitles slower than the English L1 speakers. The Sesotho L1 speakers in test group TES, who read English subtitles during the first half of the film, read the English subtitles faster than the Sesotho L1 speakers in both test group TSE (difference = 290 ms, $t = -3.17, p<0.01$) and control group CSS (difference = 563 ms, $t = -6.80, p<0.01$) who read Sesotho subtitles during the first half of the film. These differences had small ($d = 0,34$) and medium ($d = 0,67$) effect sizes respectively. Participants in control group CEE were found to read the subtitles the fastest of all the groups ($M = 2568.123, SD = 811.410$), 298 ms faster than test group TES ($t = 3.34, p<0.01$). This difference had a small effect size ($d = 0,36$).

In the second half of the film there was also statistically significant interaction between language and condition ($F(1, 776)=17.291, p<0.001$), again with a significant main effect for language ($F(1, 776)=53.771, p<0.001$), which means that, as in the first half of the film, the Sesotho and English subtitles were read differently – the English subtitles were read 429 ms faster than the Sesotho subtitles ($t = 6.88, p<0.01$). This difference had a medium effect size in terms of Cohen’s practical significance ($d = 0,47$). The Sesotho L1-speaking participants who read Sesotho subtitles during the second half of the film (test group TES and control group CSS) read the subtitles very similarly with a difference of only 87 ms ($t = -0.95, p>0.05$). However, the Sesotho L1-speaking participants in test group TSE, who read English subtitles during the second half of the film, read the English subtitles faster than test group TES (difference = 193 ms, $t = -2.36, p<0.05$), a difference with a small effect size ($d = 0,23$), but they did not read much faster than control group CSS (difference = 106 ms, $t = -1.17, p>0.05$) who both read Sesotho subtitles. As was found in the first half of the film, control group CEE read the fastest of all the groups ($M = 2527.088, SD = 727.389$), 592 ms faster than TSE ($t = 7.49, p<0.01$). This difference had a medium effect size ($d = 0,74$). This means that the Sesotho L1-speaking participants generally read the subtitles slower than the English L1-speaking participants, regardless of whether the subtitles were Sesotho or English.

Fixation time total

In the first half of the film there was significant interaction between language and condition for dwell time ($F(1, 658)=36.234, p<0.01$), with significant main effect for language ($F(1, 658)=58.652, p<0.01$). This indicates that the Sesotho and English subtitles were read differently during the first half of the film – in terms of fixation time the English subtitles were read 346 ms faster than the Sesotho subtitles ($t = 5.63, p<0.01$). This difference had a small effect size in terms of Cohen’s practical significance ($d = 0,42$). Control group CEE read the English subtitles 275 ms faster than test group TES who read English subtitles during the first half of the film ($t = -3.45, p<0.01$), while test group TSE who read Sesotho subtitles during the first half of the film read the Sesotho subtitles 624 ms faster than control group CSS ($t = 7.22, p<0.01$) who also read Sesotho subtitles. These differences had small ($d = 0,36$) and medium ($d = 0,69$) effect sizes respectively. In contrast to the findings for dwell time, test group TSE, who read Sesotho subtitles during the first half of the film, read the Sesotho subtitles faster in terms of fixation time than test group TES, who read English subtitles during the first half of the film (difference = 96 ms, $t = 1.07, p>0.05$) – although this difference was not statistically significant, it still indicates that, in terms of fixation time, less time was spent fixating the Sesotho than the English subtitles. Furthermore, test group TSE read the Sesotho subtitles only 179 ms slower than control group CEE ($t = -1.96, p>0.05$) who read subtitles the fastest of all the groups.

In the second half of the film no statistically significant interaction was found between language and condition for fixation time ($F(1, 776)=0.34198, p>0.05$). There was, however, a significant main effect for language ($F(1, 776)=153.75, p<0.01$). This indicates that the Sesotho and English subtitles, respectively, were read the same by the different groups but that, overall, the Sesotho and English subtitles were read differently – in terms of fixation time the English subtitles were read 709 ms faster than the Sesotho subtitles ($t = 12.40, p<0.01$). This difference had a large effect size in terms of Cohen’s practical significance ($d = 0.87$). As was found for the reading of one-line subtitles, the Sesotho L1-speaking participants who read Sesotho subtitles during the second half of the film (test group TES and control group CSS) read the subtitles very similarly with a difference of only 98 ms ($t = -1.16, p>0.05$). The Sesotho L1-speaking participants in test group TSE and the English L1-speaking participants in control group CEE, who read English subtitles during the second half of the film, also read the subtitles very similarly, with a difference of only 28 ms ($t = -0.35, p>0.05$). The only statistically significant finding was the difference in the reading of English and Sesotho subtitles.

Fixation count

In terms of fixation count statistically significant interaction was found between language and condition during the first half of the film ($F(1, 658)=12.354, p<0.01$) with a significant main effect for language ($F(1, 658)=30.089, p<0.01$). As was found for dwell time and fixation time, this indicates that the Sesotho subtitles were read differently than the English subtitles, with 1.40 more fixations being made in the Sesotho subtitles ($t = 5.29, p<0.01$). This difference had a small effect size in terms of Cohen's practical significance ($d = 0,40$). The Sesotho L1 speakers in control group CSS, who read Sesotho subtitles during the first half of the film, made 0.40 more fixations than the Sesotho L1 speakers in test group TSE, who also read Sesotho subtitles ($t = 1.09, p>0.05$), and 0.92 more fixations than test group TES, who read English subtitles during the first half of the film ($t = 2.49, p<0.05$). This difference had a small effect size ($d = 0,41$). Control group CEE, the English L1 speakers, made the smallest number of fixations ($M = 11.0, SD = 3.32$), 1.44 fixations less than test group TES who also read English subtitles during the first half of the film ($t = -3.89, p<0.01$). This difference also had a small effect size in ($d = 0,41$).

In the second half of the film there was also statistically significant interaction between language and condition ($F(1, 776)=7.4805, p<0.01$), with a significant main effect for language ($F(1, 776)=13.951, p<0.01$). This indicates that the Sesotho and English subtitles were read differently – on average, 0.92 more fixations were made during Sesotho subtitle reading than when reading English subtitles ($t = 3.46, p<0.01$). This difference had a small effect size in terms of Cohen's practical significance ($d = 0,23$). The Sesotho L1 speakers in test group TES, who read Sesotho subtitles during the second half of the film, made 0.66 more fixations than the Sesotho L1 speakers in both control group CSS ($t = -1.63, p>0.05$), who also read Sesotho subtitles, and 0.26 more fixations than the Sesotho L1 speakers in test group TSE ($t = -0.75, p>0.05$) who read English subtitles during the second half of the film. These differences were all non-significant, which means that the Sesotho L1 speakers read the subtitles very similarly, whether they were in Sesotho or English. Participants in control group CEE made the smallest number of fixations of all the groups ($M = 11.23, SD = 3.00$), 2.08 fixations fewer than test group TSE ($t = -6.48, p<0.01$). This difference had a medium effect size in terms of Cohen's practical significance ($d = 0,64$).

All three parameters used to measure absorption therefore indicate significant differences in the reading of Sesotho and English subtitles, the most significant finding being that English subtitles,

in general, were read faster than Sesotho subtitles. Furthermore, all three parameters indicate that English subtitles were read slower when read as L2 text by test groups TES and TSE than when read as L1 text by control group CEE.

5.3.3.2 Vertical movement

In general, no statistically significant differences were found for glance and revisitors counts for Sesotho L1 speakers reading Sesotho two-line subtitles, meaning that all Sesotho L1-speaking participants read the two-line subtitles the same in terms of the vertical movements made between the subtitled area and the rest of the screen. In general it was found that the Sesotho L1 speakers made fewer jumps between the subtitled area and the rest of the visuals on the screen than the English L1 speakers when reading two-line subtitles. When compared to Chapter 4 these findings agree with the findings for Afrikaans and English subtitle reading – Afrikaans speakers also generally made fewer jumps between the subtitled area and the rest of the screen than the English L1 speakers.

In terms of the similarities with the findings for one-line subtitles, there were also significant differences in the reading of Sesotho and English two-line subtitles during the first half of the film – significantly fewer glances and revisits were made when reading the Sesotho subtitles than when reading the English subtitles. During the second half of the film, however, the findings for two-line subtitle reading differ considerably from those for one-line subtitle reading – during the second half of the film, the Sesotho L1-speaking participants in groups TSE, CSS and TES displayed similar reading patterns, with glances and revisitors count values being almost exactly the same, regardless of whether they read English or Sesotho subtitles. Control group CEE stood out, having made considerably more vertical movements than all the rest. In the second half of the film there was therefore a large difference in L2 and L1 reading of English subtitles – test group TSE made considerably fewer vertical movements than CEE when reading the English two-line subtitles.

These findings differ significantly from what was reported for the reading of Afrikaans and English two-line subtitles in Chapter 4. Firstly, whereas the Sesotho and English subtitles were read differently throughout the entire film (much fewer jumps were made between the subtitled area and the rest of the screen by the groups reading the Sesotho subtitles than by the groups reading the English subtitles in both halves), the Afrikaans data indicated that the Afrikaans

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

speakers were grouped together in the first half of the film (whether they read Afrikaans or English subtitles), making much fewer jumps between the subtitled area and the rest of the screen than the English L1-speakers in control group CEE. In the second half of the film this changed – the Sesotho data now reflected the Afrikaans viewing pattern for the first half, and the Afrikaans data reflected the Sesotho viewing pattern for the first half. Whereas the Afrikaans test group reading English subtitles during the second half of the film (TAE) now made more jumps between the subtitled area and the rest of the screen than the groups reading Afrikaans, nearly reflecting the viewing pattern of the English L1 speakers in control group CEE, the Sesotho speaking participants in groups TSE, CSS and TES now displayed similar reading patterns, with glances and revisitors count values being almost the same regardless of whether they read English or Sesotho subtitles.

Secondly, whereas the Afrikaans test group TEA (who changed from reading English subtitles to Afrikaans subtitles) displayed nearly the same viewing pattern for the first and second halves of the film despite the change in language, the Sesotho test group TES (who changed from reading English subtitles to Sesotho subtitles) showed a significant decrease in the number of jumps made between the subtitled area and the rest of the screen, clearly indicating a difference in the way in which Sesotho and English subtitles were read, but not Afrikaans and English subtitles. An interesting finding here is that the Sesotho test group TSE (who changed from reading Sesotho subtitles to English subtitles) did not show any increase in the number of jumps made between the subtitled area and the rest of the screen. This is completely different from what was found for the same group for their reading of one-line subtitles and also for the reading of Afrikaans and English subtitles (both one-line and two-line subtitles) – Afrikaans participants in test group TAE made significantly more jumps between the subtitled area and the rest of the screen for English subtitle reading during the second half of the film, nearly reflecting the viewing pattern of the English L1-speaking participants in control group CEE. The Sesotho L1-speaking participants in test group TSE, however, retained the same viewing pattern as for their reading of the Sesotho subtitles during the first half of the film.

Thirdly, for the groups who read English subtitles during the second half of the film (TAE and TSE), the difference between L1 and L2 English reading was much more evident for the Sesotho L1 speakers than the Afrikaans L1 speakers, mainly because participants in test group TSE did not increase the number of jumps made between the subtitled area and the rest of the screen for their reading of the English subtitles during the second half of the film.

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

As was found for absorption, the overall findings indicate that the Sesotho speakers were more comfortable reading the English two-line subtitles than the Sesotho two-line subtitles, but only during the first half of the film. Their viewing pattern for the reading of English subtitles in terms of jumping between the subtitled area and the rest of the screen resembled that of the English L1 speakers, with more vertical movements being made for the reading of English subtitles than for the reading of Sesotho subtitles. This was not the case for English subtitle reading during the second half of the film. As was found for one-line subtitles, the Sesotho speakers’ reading of the L2 English subtitles was not optimal – they needed more time in order to read the subtitles more easily, which would be reflected, in this case, in a more regular viewing patterning and the equal distribution of attention between the subtitled area and the rest of the visuals above it.

Two-line subtitles											
		First half					Second half				
Cond	Lang	Glances count		Revisitors count		N	Glances count		Revisitors count		N
		Means	Std.Dev.	Means	Std.Dev.		Means	Std.Dev.	Means	Std.Dev.	
C	S	1.21	0.48	0.18	0.39	160	1.28	0.53	0.24	0.43	200
C	E	1.65	0.71	0.54	0.50	162	1.62	0.78	0.48	0.50	180
T	S	1.32	0.53	0.29	0.45	160	1.30	0.59	0.24	0.43	200
T	E	1.52	0.67	0.43	0.50	180	1.33	0.54	0.30	0.46	200

Table 5.10 Means and standard deviations of the parameters indicating the vertical movements made when reading two-line subtitles for the first and second halves of the film.

Glances count

In the first half of the film the interaction between language and condition was statistically significant ($F(1, 658)=6.3473, p<0.05$), with a significant main effect for language ($F(1, 658)=46.524, p<0.01$). In other words, the number of glances made to the subtitles differed significantly when reading Sesotho and English two-line subtitles during the first half of the film – on average, 0.32 more glances were made when reading English subtitles than when reading Sesotho subtitles ($t = -6.73, p<0.01$), which is a significant difference in terms of the scale of values. This difference had a medium effect size in terms of Cohen’s practical significance ($d = 0,46$). There were no statistically significant findings for the reading of Sesotho two-line subtitles, and no other significant differences were found in general.

In the second half of the film the interaction between language and condition was also statistically significant ($F(1, 776)=12.987, p<0.01$) with a significant main effect for language

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

($F(1, 776)=17.404, p<0.01$). As was found for the first half of the film, the number of glances made to the subtitles differed significantly when reading Sesotho and English two-line subtitles – on average, 0.18 more glances were made when reading English subtitles than when reading Sesotho subtitles ($t = -3.95, p<0.01$), which is a significant difference in terms of the scale of values. This difference had a small effect size in terms of Cohen’s practical significance ($d = 0,26$). The pattern for subtitle viewing in terms of the number of glances made to the subtitles during the second half of the film resembles that of the first half of the film, but for the reading of Sesotho subtitles only – in contrast to findings for the reading of one-line subtitles, the number of glances made to the subtitles for English subtitle reading during the second half of the film differs greatly for test group TSE and control group CEE. The Sesotho L1-speaking participants in test group TSE, who read the English subtitles as L2 text, made 0.30 fewer glances to the subtitles than the English L1-speaking participants in control group CEE, who read the English subtitles as L1 text ($t = 4.36, p<0.01$). This difference had a small effect size ($d = 0,38$). What is interesting here, is that test group TSE made almost the exact number of glances during the first half of the film for Sesotho subtitle reading ($M = 1.32, SD = 0.53$) as during the second half of the film for English subtitle reading ($M = 1.33, SD = 0.43$), which means that they retained the same viewing pattern consistently throughout the entire film. Instead of resembling the viewing patterns of control group CEE, as was found for the reading of one-line subtitles, test group TSE’s viewing pattern for the reading of two-line subtitles rather resembles the viewing patterns of the other Sesotho L1-speaking participants in groups TES and CSS. Test group TES made 0.22 fewer glances to the subtitles during the second half of the film for Sesotho subtitle reading ($M = 1.3, SD = 0.59$) than during the first half of the film for English subtitle reading ($M = 1.52, SD = 0.67$). There were no statistically significant findings for the reading of Sesotho two-line subtitles, and no other statistically significant differences were found in general.

Revisitors count

Statistically significant interaction was found between language and condition for revisitors count in the first half of the film ($F(1, 658)=8.9547, p<0.01$), with a significant main effect for language ($F(1, 658)=47.446, p<0.01$). This means that the number of revisits made to the subtitled area differed significantly for the reading of Sesotho and English subtitles – on average, 0.25 more revisits were made to the subtitled area during English subtitle reading than for Sesotho subtitle reading ($t = -6.78, p<0.01$), which is a significant difference in terms of the scale of values. This difference had a medium effect size in terms of Cohen’s practical significance

($d = 0,49$). There were no statistically significant findings for the reading of Sesotho two-line subtitles.

The second half also showed statistically significant interactions between language and condition ($F(1, 776)=7.5067, p<0.01$), also with a significant main effect for language ($F(1, 776)=21.061, p<0.01$). This again indicates that the number of revisits made to the subtitled area differed significantly for the reading of Sesotho and English subtitles – on average, 0.14 more revisits were made to the subtitled area during English subtitle reading than for Sesotho subtitle reading ($t = -4.41, p<0.01$), which is a significant difference in terms of the scale of values. This difference had a small effect size in terms of Cohen's practical significance ($d = 0,31$). The pattern for subtitle viewing in terms of the number of revisits made to the subtitled area during the second half of the film resembles that of the first half of the film, but for the reading of Sesotho subtitles only – in contrast to findings for the reading of one-line subtitles, the number of revisits made to the subtitled area for English subtitle reading during the second half of the film differs greatly for test group TSE and control group CEE. The Sesotho L1-speaking participants in test group TSE, who read the English subtitles as L2 text, made 0.18 fewer revisits to the subtitled area than the English L1-speaking participants in control group CEE who read the English subtitles as L1 text ($t = 3.72, p<0.01$). This difference had a small effect size ($d = 0,36$). What is interesting here, is that test group TSE made almost the exact number of glances during the first half of the film for Sesotho subtitle reading ($M = 0.29, SD = 0.45$) as during the second half of the film for English subtitle reading ($M = 0.295, SD = 0.46$), which means that they retained the same viewing pattern consistently throughout the entire film. Instead of resembling the viewing patterns of control group CEE, as was found for the reading of one-line subtitles, test group TSE's viewing pattern for the reading of two-line subtitles rather resembles the viewing patterns of the other Sesotho L1-speaking participants in groups TES and CSS. Test group TES made 0.20 fewer revisits to the subtitled area during the second half of the film for Sesotho subtitle reading ($M = 0.24, SD = 0.43$) than during the first half of the film for English subtitle reading ($M = 0.43, SD = 0.50$). There were no statistically significant findings for the reading of Sesotho two-line subtitles.

Both parameters used to measure vertical movement indicate significant differences in the reading of Sesotho and English subtitles – there was significantly less vertical movement between the subtitles and the rest of the screen for Sesotho subtitle reading than for English subtitle reading. Furthermore, during the second half of the film, the Sesotho L1 speakers (TSE,

TES and CSS) all displayed the same viewing pattern in terms of interaction between the subtitled area and the rest of the screen, regardless of whether they read Sesotho or English subtitles – their values were significantly lower than that of the English L1-speakers. In other words, the Sesotho L1 speakers made fewer vertical movements than the English L1 speakers. There were no statistically significant findings for the reading of Sesotho one-line subtitles.

5.3.4 Conclusion

Participants in all groups were found to spend proportionally more time reading two-line than one-line subtitles. This agrees with the findings of previous studies (Praet *et al.*, 1990; d’Ydewalle *et al.*, 1991; De Bruycker & d’Ydewalle, 2003; d’Ydewalle & De Bruycker, 2007). In terms of processing (absorption), the Sesotho-speaking participants in both the test groups (TES, TSE) and the control group (CSS) spent more time overall reading the two-line subtitles than the English-speaking participants in control group CEE. Regarding the language of the subtitles, the English subtitles were read faster by native speakers than non-native speakers throughout the film, with only a few exceptions. This was found for one-line and two-line subtitles. In general, the Sesotho L1-speaking participants were found to spend more time reading the subtitles than the English L1-speaking participants, regardless of whether the subtitles were in Sesotho or English. These findings agree with the findings for the reading of Afrikaans and English subtitles as discussed in Chapter 4. The biggest difference between the Sesotho data and the Afrikaans data, however, is the difference between the overall reading of Sesotho and English subtitles – in general the Afrikaans and English subtitles were not read that much differently from each other, but the Sesotho subtitles were consistently read significantly slower than the English subtitles. In contrast to the single primary finding for Chapter 4, that there is a significant difference in the reading of English subtitles when read as L1 and L2 text during the second half of the film, the Sesotho data in the current chapter offered two primary findings: firstly, that there is a significant difference in the reading of Sesotho and English subtitles in general, and secondly, that there is a significant difference in the reading of English subtitles when read as L1 and L2 throughout the film.

In terms of vertical movement, the number of glances and revisits made by the Sesotho L1-speaking participants when reading English subtitles were found to differ significantly from those made by the English L1-speaking participants. There were also significant differences between the number of glances and revisits made when reading Sesotho and English subtitles in

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

general – significantly fewer glances and revisits were always made when reading Sesotho subtitles. This was found for both one-line and two-line subtitles, and agrees with the findings for the reading of Afrikaans and English subtitles as discussed in Chapter 4. An interesting finding, however, was that for test group TSE, who read Sesotho subtitles during the first half of the film and English subtitles during the second, there was almost no difference in viewing pattern for reading Sesotho and English subtitles in terms of vertical movement. This was found for the reading of two-line subtitles only. In contrast to the findings for one-line subtitles, test group TSE did not show an increase in the number of glances and revisits made to the subtitles when shifting from reading Sesotho subtitles during the first half of the film to reading English subtitles during the second half. In this regard the viewing pattern of test group TSE was in agreement with that of the other Sesotho L1 speakers who read Sesotho subtitles, and not with the viewing pattern of the English L1-speaking participants in control group CEE, as was found for the reading of one-line subtitles. It was also completely different from what was found for the reading of Afrikaans and English subtitles, where the test group who read English subtitles during the second half of the film (test group TAE) also made more glances and revisits when reading the English subtitles during the second half of the film. For the Sesotho L1 speakers in test group TSE the English L2 subtitles therefore proved more difficult to read than for the Afrikaans L1 speakers in test group TAE as well as the English L1 speakers in control group CEE. If one draws the assumption from the findings of d’Ydewalle and De Bruycker (2007) (cf. section 5.3.1) that a better reading and understanding of subtitles coincides with more vertical movements between the subtitled area and the visuals above it, the patterns found for the reading of Sesotho and English subtitles in the current study (more vertical movement for English than Sesotho subtitles in general) means that participants read and understood the English subtitles better than the Sesotho subtitles. From what was found in terms of processing, this might be an accurate assumption, but because not much is known about the relevance of vertical movement in this regard, the assumption drawn from d’Ydewalle and De Bruycker (2007) is not supported or further elaborated upon in the current study.

In conclusion, significant differences were found for the reading of Sesotho and English subtitles, as well as for the reading of English subtitles when read as L1 and L2 text. This was found consistently across all groups and for both one-line and two-line subtitles. In Chapter 4, for the reading of Afrikaans and English subtitles, the only significant difference found was for the reading of English subtitles when read as L1 and L2 text during the second half of the film and for one group only, test group TAE. The next step was therefore to find out if the differences

found for English subtitle reading could be attributed purely to the L2 reading of English subtitles. Consequently possible confounding variables in the form of secondary data were considered and analysed. However, because more significant differences were found for the reading of Sesotho and English subtitles and because some of these differences were due to poor L1 reading, one can conclude that the differences are attributed to something greater than merely L2 reading. Consequently the secondary data was analysed with a slightly different purpose: to see if the secondary data support the primary findings, and also to emphasise that the differences found for subtitle reading are not merely due to differences in first and second language reading, but rather the languages themselves and the socioeconomic backgrounds of the readers.

5.4 SECONDARY DATA: CONFOUNDING VARIABLES

Confounding variables that may potentially have influenced or could explain participants' subtitle reading include participants' reading speeds for static text and their corresponding levels of comprehension, the length of the subtitles (word and character count), participant demographics, participants' television and film viewing habits, and participants' attitude toward reading subtitles. However, of all the variables that might have influenced the Sesotho L1-speaking participants' subtitle reading, the biggest has to be the participants' socioeconomic background and history. As was mentioned in the discussion of the participant demographics (cf. section 5.2), most of the Sesotho L1-speaking participants who took part in this study are first generation students. In addition to coming from a background that does not put much emphasis on literacy, they come from a background where "a proper culture of teaching and learning remains evasive" (Wolhuter, 2011:282). This is a problem that, of course, extends beyond the Sesotho language group and applies to the broader South African context. There is still a great difference between what are known as historically white and historically black schools, with poor quality concentrated in the historically black schools and "thus undermining any attempt at equalisation of educational opportunity" (Wolhuter, 2011:280). Looking at the physical manifestation of this lack of quality, Wolhuter (*ibid.*) notes that the majority of historically black schools lack proper resources (telephones, electricity, computers) as was found in a survey conducted by the Department of Education in 2000. Books and educational materials, however, are not on this list, although it is known that there is a lack of especially reading material in the various African languages.

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

Other issues affecting the quality of education include equality and multiculturalism (or rather the lack thereof). According to Wolhuter (2011:281) “[d]espite reform, education remains unequal along racial lines”. He states that the historically white schools are comparable to the best schools in the world while the historically black schools are “grossly inferior” (*ibid.*). The relevance of this for the current study can be seen in the figures listed by Bloch in the following:

The reality - despite vast spend and many resources - is that South African schools are failing to perform. Results are among the worst in Africa - about 30% of children in grades 3 or 6 perform at the level required for literacy or numeracy. All international tests show that our children are just not getting it. While 50% or more white children go on to university, only 12% of black children do. Half the children drop out before finishing matric. In former white schools in the Western Cape, 62.5% of grade 3s could read and count at appropriate levels; the corresponding figure in African townships was 0.1%. One in 10 whites get an A-level pass in matric; only one in 1000 blacks.

(Bloch, 2009)

Regarding multiculturalism in the educational environment, Wolhuter (2011:281) states that he sees this is an ideal that is yet to be achieved. He goes on to say that no progress has been made “in the development of African languages as a medium of instruction beyond the level of Grade 4” and that this is despite the fact that research has indicated the negative impact of non-mother-tongue teaching and learning on the progress made by the learners (*ibid.*). This is also despite the fact that the Constitution states that “everyone has the right to receive education in the official language or languages of their choice where that education is reasonably practiceable.” (South Africa, 1996:14). Educational constraints in terms of language use often cause the speakers of African languages to be more literate and proficient in their L2 (usually English, the language of instruction) than their home language, especially in an academic context. According to Pretorius and Currin (2010:68) reading instruction in many of the South African primary schools catering for African children “is not conducive to sound reading development”. If (and when) schooled in their home language, this schooling rarely extends beyond third grade level, and during these first few vital years of learning, focus is often only on decoding rather than comprehension, with little attention paid to reading comprehension (*ibid.*). Furthermore, there are very limited reading materials in the home languages of these children. They therefore never really have the opportunity to read for the pleasure of reading or understanding, and when the language of instruction is changed to English after three years, these children are ill-equipped in their reading capabilities in both their home language and English (*ibid.*).

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

After incorporating an intervention at a high poverty state primary school over a period of three years, Pretorius and Currin (2010) found that the reading comprehension scores of Grade 7 learners improved for both L1 (Northern Sotho) and L2 (English), but that the scores were consistently higher for English than for Northern Sotho, both in terms of the overall findings and after each year in which the intervention was implemented (Pretorius & Currin, 2010:70). The same was found for reading speed – children read much slower in Northern Sotho than in English (*ibid.*). These increases were attributed to the fact that children “were becoming more accustomed to reading and were reading more” (Pretorius & Currin, 2010:70). If these children were to read subtitles, L2 subtitles would obviously have been more readable than L1 subtitles, but the children would still have struggled with the reading as subtitles present additional complexities that are not present in static texts. The findings of the study by Pretorius and Currin (2010) may be based on the reading of Grade 7 learners from a specific school, but the difficulties in terms of reading development and exposure might be applied to the broader context of African languages spoken (and read) in South Africa as a whole – this is not an isolated case; the same issue of language of teaching and learning and reading development leading to greater proficiency in L2 than L1 reading exists for the majority of African language speakers in the South African educational environment.

For Afrikaans L1 speakers the difference in reading L1 and L2 is not large, but the difference that exists favours the L1. That is why Afrikaans L1 speakers were chosen for the first component of the current study – because there are limited factors influencing language learning and usage (for both Afrikaans and English), the data and findings could serve as the baseline for comparison with other languages, in this case, Sesotho. That is also why the findings for the reading of Afrikaans and English subtitles did not point to as many significant differences as the findings for the reading of Sesotho and English subtitles, and also explains why the secondary data was analysed with a different purpose in mind for the Sesotho L1 speakers.

Each of the potentially confounding variables was evaluated against three criteria to see if it could explain the differences found in subtitle reading: statistically significant effect, linear relation and participant distribution. The variables passed the first two criteria to a varying extent. However, in the end none passed all three criteria to support an alternative hypothesis that the differences observed for subtitle reading could be attributed to a factor other than L1 and L2 reading. As in Chapter 4, correlations were performed with the variables in order to find

significant interactions. The results of the correlations between these variables and the eye-tracking data for the reading of subtitles are discussed in the sections to follow.

5.4.1 Reading speed for static text

As explained in Chapter 3, participants were given static text to read which was accompanied by a multiple-choice comprehension test. The main interest in gathering this data was the consideration of reading speed and comprehension as possible confounding variables. Furthermore, because participants read the text before watching the subtitled film, they familiarized themselves with the equipment.

For the test groups there are two sets of values, one for Sesotho reading speed and comprehension, and one for English reading speed and comprehension, while the control groups have only one set of values each for either Sesotho or English. Table 5.11 contains the values per participant as well as per group. When considering the reading speeds overall, the groups can be ranked as follows:

- | | | |
|---------|-----------|-------------|
| (1) CEE | (English) | = 182.9 wpm |
| (2) TES | (English) | = 154.8 wpm |
| (3) TSE | (English) | = 122.5 wpm |
| (4) TES | (Sesotho) | = 107.5 wpm |
| (5) CSS | (Sesotho) | = 99.7 wpm |
| (6) TSE | (Sesotho) | = 94.2 wpm |

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

Reading speed and comprehension scores				
	Sesotho		English	
Case	Reading speed [wpm]	Comprehension test score %	Reading speed [wpm]	Comprehension test score %
TSE	61	60	97	30
TSE	55	50	68	50
TSE	95	60	109	40
TSE	100	70	142	50
TSE	97	100	69	50
TSE	109	60	172	50
TSE	95	60	114	80
TSE	116	60	132	60
TSE	88	80	141	80
TSE	125	70	179	20
Average TSE	94.2	67.0	122.5	51.0
TES	105	100	122	60
TES	114	80	172	70
TES	103	80	147	30
TES	103	80	143	50
TES	111	100	199	80
TES	90	80	122	40
TES	88	80	100	30
TES	127	70	180	80
TES	114	50	129	20
TES	120	60	234	60
Average TES	107.5	78.0	154.8	52.0
CSS	101	90	–	–
CSS	98	60	–	–
CSS	107	90	–	–
CSS	132	70	–	–
CSS	128	80	–	–
CSS	132	50	–	–
CSS	83	50	–	–
CSS	50	70	–	–
CSS	85	60	–	–
CSS	81	40	–	–
Average CSS	99.7	66.0	–	–
CEE 1	–	–	206	40
CEE 2	–	–	151	80
CEE 3	–	–	141	60
CEE 4	–	–	151	40
CEE 5	–	–	171	60
CEE 6	–	–	184	60
CEE 7	–	–	250	70
CEE 8	–	–	216	80
CEE 9	–	–	176	50
Average CEE	–	–	182.9	60.0

Table 5.11 Results for the reading of static text and comprehension test(s). Reading speed was measured as words per minute (wpm) and the scores for the comprehension tests were calculated as a percentage mark.

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

Chapter 3 stated that students, after having completed the Reading Laboratory programme, should be able to read at a reading speed of 420 wpm at 80% comprehension (cf. section 3.4.1).⁴⁸ In comparison the Sesotho L1-speaking participants in the current study, although they were instructed to read at their own pace, are clearly reading below the expected level. However, as was stated in Chapter 4, data on reading speed and comprehension should be interpreted with some care – in assessing the numeric values obtained from investigations, one has to be careful about the benchmarks against which performance is assessed. Carver (1990, 1992) has put forth a very comprehensive theory of different factors influencing reading rate and specifically proposes a value of 300 wpm for the third of five so-called gears of reading, termed ‘rauding’, the most comfortable rate for comprehension and eye-movements. Carver (1992:85) contrasted this third gear to the second gear which he termed the learning process. The reading rate in second gear is about 200 wpm, and is employed when the reader knows that he/she will be held accountable for their comprehension, for example by being asked questions on the content. This is in turn quicker than the first gear, memorising, which is characterised by a reading rate of about 138 wpm. Based on the instructions given in the current study, participants were likely to have read in the so-called second gear, which might explain the slightly lower than expected reading rates.

Nevertheless, when considering overall reading achievement, it is generally recognized that students’ reading capabilities are not what they ought to be, and not only at the campus where the current study was conducted. In her study on the reading abilities of undergraduate students studying at Unisa, Pretorius (2000:36) found that most of the participants read at reading speeds lower than 150 wpm, the “recommended minimum for L2 readers (cf. section 5.3). In the current study only one group of English L2 readers, test group TES, was found to read above this “minimum” level when reading the English text, and did so at a pace of 154.8 wpm. Furthermore, one would expect readers to read better in their L1, but as was found in the current study the Sesotho L1-speaking participants struggled even more when reading in their L1 – participants read much slower when reading in Sesotho than when reading in English. This can be attributed to the fact that there are very few materials available for reading in Sesotho and that their Sesotho reading skills are rarely practiced. Yet one cannot ascribe faster reading to better reading – even though the Sesotho L1-speaking participants consistently read the static text

⁴⁸ The Reading Laboratory only uses English and Afrikaans texts; no texts or reading programmes have been implemented in the Reading Laboratory for Sesotho or any other African languages.

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

faster in English than in Sesotho, their comprehension scores indicate a better level of comprehension when reading in Sesotho (Table 5.12).

Static text reading: Sesotho and English								
	Sesotho		English		N	df	T	p
	Means	Std.Dev.	Means	Std.Dev.				
Reading speed [wpm]	100.9	18.6	138.6	42.0	20	19	5.447	<0.001
Comprehension [%]	72.5	15.5	51.5	19.8	20	19	4.320	<0.001

Table 5.12 Comparative data of Sesotho L1-speaking participants’ reading skills for Sesotho and English static text reading measured in terms of their reading speed (words per minute) and comprehension scores (percentage value).

From Table 5.12 it is evident that the Sesotho L1-speaking participants read the English text significantly faster than the Sesotho text (37.7 wpm). This difference in reading speed had a large effect size in terms of Cohen’s practical significance ($d = 0,9$). In terms of comprehension, however, these participants scored significantly lower in the comprehension test for English static text reading than in the comprehension test for Sesotho static text reading (21%). This difference in comprehension also had a large effect size in terms of Cohen’s practical significance ($d = 1,1$). Because of enhanced understanding, these findings indicate that, to some extent, there is still a benefit for the reader when reading in their mother-tongue despite the lack of exposure to mother-tongue reading materials. The findings also indicate that people’s perception of their level of English proficiency is often inaccurate – in the questionnaire on their reading behaviour, reading preferences, access to subtitled television programming and subtitle reading, many of the Sesotho L1-speaking participants indicated that they considered English to be their strongest language, outranking their home language. This, however, is contradicted by the data gathered for the reading of the static texts. This agrees with the findings of Coetzee-Van Rooy and Verhoef (2000) as stated in Chapter 1 (cf. section 1.1), namely that second and third language speakers of English typically overestimate their proficiency in this language and that their actual proficiency levels “does not empower them for sufficient access to certain domains” (Coetzee-Van Rooy & Verhoef, 2000:175).

In general, the reading speeds of participants in the current study are below average and what is expected at university level, flagging the low reading speeds and corresponding levels of comprehension as a source of concern.

5.4.1.1 Correlation between reading speed and subtitle reading

The relation between reading speed for static text and subtitle reading was analysed for three purposes – to find the correlation(s) between reading speed and subtitle processing (absorption), reading speed and vertical movement, and reading speed for static text and reading speed for subtitles. The correlation between reading speed and subtitle processing was the primary concern and was the only one evaluated against the three criteria to see if it could explain the differences found in subtitle reading. In other words, the following three questions had to be asked:

- Did it have a significant effect on subtitle reading?
- If so, was the effect linear and in the hypothesized direction? (i.e. did it hold an advantage for subtitle reading?)
- If so, did it agree with the distribution pattern found for the observed difference in subtitle reading? (i.e. did the findings for static text reading agree with the findings for subtitle reading?)

All three these conditions had to be satisfied in order for reading speed to explain the differences found for subtitle reading.

Absorption

In contrast to the findings for Afrikaans speakers, both negative and positive correlations were found when comparing the reading speed for static text with the processing (absorption) of subtitles. The negative correlations were expected but not the positive correlations, as this implies that participants' reading of subtitles does not benefit from their reading skills for static text reading – when assessing reading speed for static text reading (measured in words per minute) higher values are better, indicating faster reading; when assessing subtitle reading (measured in terms of the amount of time spent reading the subtitles) lower values are better, indicating faster reading.

In terms of dwell time and fixation time the correlations were mostly negative, meaning that the faster participants read the static text in terms of words per minute, the less time was spent in the subtitled area. This was expected and measured in the hypothesized direction, but the effects were very small. In terms of fixation count, however, the positive correlations indicate that the

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

faster participants read the static text in terms of words per minute, the more fixations were made in the subtitled area. This was not expected and did not measure in the hypothesized direction – it does not coincide with the rest of the findings, and can therefore be disregarded.

Correlations: Reading speed vs. Absorption parameters								
Group	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		r	p	r	p	r	p	
CSS	S	-0.1645	0.000	-0.2146	0.000	0.1541	0.000	620
TSE & TES	S	0.1347	0.001	0.0869	0.030	0.1299	0.001	620
CEE	E	-0.1468	0.001	-0.1876	0.000	-0.1236	0.005	522
TSE & TES	E	-0.0860	0.038	0.1333	0.001	-0.0456	0.273	580

Table 5.13 Correlations between reading speed and all three parameters used to measure absorption.

Additional measures were also analysed. These included the global variables of dwell time in a subtitle as a percentage of the visible time of the respective subtitle (in other words, how long someone spent reading the subtitle while the subtitle was on-screen), as well as dwell time in subtitles per language (Sesotho or English) as a percentage of the visible time of the respective subtitled language (in other words, how long someone spent reading the Sesotho or English subtitles calculated for the entire time the subtitles were visible in the respective language). Predominantly small, negative correlations were found for these measures as well.

In terms of Cohen's scale of effect sizes, a correlation was found between reading speed in particular and the global variable of dwell time per language as a percentage of the total visible time of the subtitled language. As can be seen in Table 5.14 there was a greater effect for English ($r = -0.2672$) than for Sesotho ($r = -0.0603$) subtitle reading. This means that, for the English L1 speakers, the relation between how fast they read the static text and its influence on how fast they read the subtitles was greater than for the Sesotho L1 speakers. This is the opposite from what was found in Chapter 4 – the effect measured was greater for the Afrikaans L1 speakers than the English L1 speakers. In terms of the Sesotho data, the effect size was greatest for the Sesotho control group CSS ($r = -0.2712$). A small to medium effect was found for the English control group CEE ($r = -0.2058$) and very small effects were found for test groups TSE and TES combined for their reading of the English subtitles ($r = -0.0975$) as well as the Sesotho subtitles ($r = 0.0197$). These very small effects for test groups TSE and TES are so small that they can be disregarded as actual effects.

Correlations: Reading speed vs. Dwell time				
Group	Lang	Dwell time as % of Visible time	p	N
SESOTHO	S	-0.0738	0.000	1236
ENGLISH	E	-0.2713	0.000	1101
CSS	S	-0.2712	0.000	620
TSE & TES	S	0.1897	0.000	616
CEE	E	-0.2058	0.000	522
TSE & TES	E	-0.0975	0.024	579

Table 5.14 Correlations between reading speed and dwell time as a percentage of the visible time of the respective subtitle languages (per language overall and per group).

Overall the correlations between participants’ reading speed for static text and subtitle reading were very weak. This suggests that participants employed different reading strategies for reading static texts and subtitles. Taking into account these weak correlations and considering the fact that some were in opposite directions, one can exclude participants’ reading speed for static text reading as a confounding variable and predictor of participants’ subtitle reading ability.

Vertical movement

In terms of vertical movement the effect sizes for correlations with reading speed were overall small and positive. Effects were bigger for the control and test groups who read English than for the control and test groups who read Sesotho, but the effects stayed small and never increased in size. In other words, there was a correlation between reading speed and vertical movement for the reading of English subtitles – the faster the participants read the static text, the more vertical jumps were made between the subtitled area and the rest of the visuals above it. However, this effect was small throughout.

Correlations: Reading speed vs. Vertical movement						
Group	Lang	Glances count		Revisitors count		N
		r	p	r	p	
CSS	S	0.0631	0.116	0.0824	0.040	620
TSE & TES	S	0.0452	0.261	0.0149	0.712	620
CEE	E	0.2027	0.000	0.1690	0.000	522
TSE & TES	E	0.1877	0.000	0.1599	0.000	580

Table 5.15 Correlations between reading speed and the two parameters used to measure vertical movement.

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

Overall the correlations were non-significant for Sesotho, and significant (but very weak) for English. Vertical movement was not analysed in more detail because it was not part of the primary focus of the study.

Subtitle reading speed

Analyses of the individual subtitles showed that Sesotho subtitles contained an average of 9.7 words while English subtitles contained an average of 8.6 words. Based on the visible time of the subtitles (the time that the subtitles were on-screen) and the notion that the average word in English and Sesotho consist of 4.7 and 3.9 characters per word respectively (cf. footnote 44, section 5.3.1), the imposed reading speed and subtitle presentation rate was calculated as 161 wpm and 202 wpm for the English and Sesotho subtitles respectively. The separate values for one-line and two-line subtitles can be seen in Table 5.16 below:

Imposed reading speed and presentation rate based on subtitle visibility					
Lang	Lines	Word count (average)	Visible time total [ms] (average)	Imposed read speed [wpm] (average)	
				Wpm	Cps
S	1	7.6	2597	178	12
S	2	13.7	3827	220	14
S	1 + 2	10.6	3311	202	13
E	1	5.9	2638	135	11
E	2	11.1	3865	175	14
E	1 + 2	8.2	3442	161	13

Table 5.16 Imposed reading speed calculated according to the visible time and average word count of one-line and two-line subtitles per language group.

However, these values only represent the imposed reading speed with which participants were to read the subtitles, and not the actual reading speed with which the subtitles were in fact read. In order to calculate participants' actual reading speed, four measures were used: the total word count of the subtitles, the total visible time of the subtitles, the total dwell time of participants in the subtitled area, and the duration of the video starting when the first subtitle appeared and ending when the last subtitle disappeared. Based on these values, actual reading speeds were calculated per visible time, per dwell time, and for the duration of the film (see Table 5.17).

Reading speed in terms of subtitle visibility, dwell time and film duration							
	Words	Viewing parameters					
Group	Total word count for film	VT of subtitles [sec.]	Reading speed per VT [wpm]	DT in subtitles [sec.]	Reading speed per DT [wpm]	Film duration: subtitled section [sec.]	Reading speed for film: subtitled section [wpm]
CSS	6100	2054.0	178.2	1744.7	209.8	2906.0	125.9
TSE	5220	2012.8	155.6	1536.6	203.8	2906.0	107.8
TES	5860	2034.4	172.8	1613.3	217.9	2906.0	121.0
CEE	4482	1796.8	149.7	1113.0	241.6	2615.4	102.8

Table 5.17 Calculation of participants’ actual reading speed per visible time (VT) of the subtitles and dwell time (DT) in the subtitles, using the duration of the film (starting when the first subtitle appeared and ending when the last subtitle disappeared).

An estimated reading time per word was also calculated by dividing the total dwell time of participants within the individual subtitles by the number of words they contained. This can be seen in Table 5.18 below.

Calculated reading speed for subtitle reading				
Group	Lang	Half	Reading time [ms]	
			Means	Std.Dev.
ALL	S + E	1 + 2	292.6	103.0
CSS	S	1	338.1	113.0
CSS	S	2	284.9	98.2
TSE	S	1	298.6	108.9
TES	S	2	296.0	113.0
CEE	E	1	261.9	89.3
CEE	E	2	246.7	76.8
TES	E	1	295.6	93.8
TSE	E	2	312.0	95.8

Table 5.18 The estimated reading time per word calculated per language per group in milliseconds.

At this point in Chapter 4 comparisons were made between participants’ reading speeds for static text and subtitle reading in order to establish the precise relation and comment on the implications thereof. However, the data and findings for Sesotho and English subtitle reading differ significantly from what was found for Afrikaans and English subtitle reading. Up to this point, the assumption had been that the Sesotho L1-speaking participants had actually read all the subtitles and all the text within the subtitles. However, the overall weak correlations between static text and various aspects of subtitle reading prompted closer analysis of the subtitles and revealed that, for the reading of Sesotho subtitles specifically, this was not the case – on

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

numerous occasions the Sesotho speakers were not able to finish reading the Sesotho subtitles within the available presentation time. This was found for the reading of both one-line and two-line subtitles, although significantly more cases of unfinished reading were found for the reading of two-line subtitles. Because the participants did not finish reading the subtitles, the impression was given of a much faster reading rate for the subtitles than for the static text, which was in fact not the case.



Figure 5.1 Screenshots of unfinished subtitle reading by Sesotho L1-speaking participants when reading one-line Sesotho subtitles. The screenshots were taken on the last visible frame before the subtitle was taken off-screen.



Figure 5.2 Screenshots of unfinished subtitle reading by Sesotho L1-speaking participants when reading two-line Sesotho subtitles. The screenshots were taken on the last visible frame before the subtitle was taken off-screen.

The implication of this is that the calculated values for actual Sesotho subtitle reading speed cannot be trusted and needs to be excluded from further analysis and discussion – because the subtitles are embedded in the film or visual material, it is considered “part of the image” and is not discernable as text; it is therefore not possible to calculate the actual amount of words that were in fact read by the participants. And without an accurate calculation of the actual number of

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

words that were read in the Sesotho subtitles it is not possible to determine the actual reading speed at which the subtitles were read. Therefore it is not possible to establish a relation between participants’ reading speed for Sesotho static text and Sesotho subtitle reading.

In terms of the reading of English subtitles the analysis revealed that the Sesotho L1-speaking participants were able to finish reading the subtitles within the available presentation time, with only a few minor instances of unfinished reading. Consequently the relation between the Sesotho speakers’ L2 English static text and subtitle reading can be discussed here.

The overall reading speeds for English static text and subtitle reading can be seen in Table 5.19.

Comparison of reading speed for subtitle and static text reading				
Variable	English read by L1 speakers		English read by L2 speakers	
	Means	Std.Dev.	Means	Std.Dev.
Static text reading speed [wpm]	182.89	35.55	138.55	51.50
Subtitle reading time per word [ms]	254.02	83.33	304.07	95.15

Table 5.19 A comparison of reading speed for static text (wpm) and subtitle reading (ms) as calculated for English overall.

However, these reading speeds are not directly comparable as they were not calculated in the same unit of measure (wpm vs. reading time [ms] per word). If the subtitle reading time per word (ms) were to be converted to a reading speed of words per minute, 254.02 ms per word and 304.07 ms per word would correspond to reading speeds of 236 wpm and 197 wpm for L1 and L2 English subtitle reading respectively. This conversion was done by recalculating the reading time per word in milliseconds to a reading time per word in seconds (0.254 s and 0.304 s respectively) and then converting this to a reading speed per minute by using 60 (seconds) as the dividend and each of the recalculated reading times per second as the dividers (i.e. $60/0.254 = 236$ wpm and $60/0.304 = 197$ wpm). This represents the estimated reading speed for only the subtitle text reading, not for the combined effort of reading and viewing the visuals simultaneously. In other words, this is the average reading speed for the total amount of time spent dwelling in the respective subtitles. The rescaled values are reflected in Table 5.20 below.

Comparison of reading rate for subtitle and static text reading				
Variable	English read by L1 speakers		English read by L2 speakers	
	Means	Std.Dev.	Means	Std.Dev.
Static text reading rate [wpm]	183	36	139	52
Subtitle reading rate [wpm]	236	77	197	62

Table 5.20 A comparison of reading rate for static text and subtitle reading (wpm) as calculated for English overall.

The difference between L1 and L2 English reading is clear – the English L1 speakers read both the English static text and subtitles much faster than the Sesotho L1 speakers. Although the difference in static text reading was slightly bigger (44 wpm) than the difference in subtitle reading (39 wpm), the findings for subtitle reading holds greater implications for the Sesotho speakers – with static text reading the reader has the time to read the text at their own pace and cross-check information mentioned earlier on in the text, whereas with subtitle reading this is not the case; because of the fleeting nature of the subtitles the reader cannot afford to read slowly because they will miss out on information and cannot go back to re-read what they missed. In addition to not being able to read everything in the subtitles, reading slowly means that a lot of the viewing time will be spent just reading instead of reading and viewing the rest of the images on the screen. This is proven by the findings for the Sesotho speakers’ reading of the English subtitles – they spent 74% of their viewing time reading the subtitles (cf. Table 5.3). However, the English L1 speakers, despite their faster reading rate, still spent 62% of their viewing time reading the subtitles, which is not optimal either. The implications of this for Sesotho speakers in terms of subtitle reading is that they will have to develop their English reading skills so that they read even faster in order to be able to read and view subtitled programmes more optimally.

5.4.1.2 Correlation between reading comprehension and subtitle reading

In terms of the global variable of dwell time per language as a percentage of the total visible time of the subtitled language, negative correlations were found when comparing participants’ reading comprehension for English static text reading with their reading of the English subtitles. The negative correlations were expected as it means that greater comprehension corresponds to less time being spent in the subtitle – participants need not have spent a lot of time reading the subtitle in order to understand what was being said.

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

Correlations: Reading comprehension vs. Dwell time				
Group	Lang	Dwell time as % of Visible time	p	N
CEE	E	-0.2617	0.000	522
TSE & TES	E	-0.1545	0.000	579

Table 5.21 Correlations between reading comprehension and dwell time as a percentage of the visible time of the subtitles.

The negative correlations, which were found for test groups TSE and TES and control group CEE for their English static text and subtitle reading were expected and measured in the hypothesized direction. In terms of English subtitle reading, the effect was therefore greater for the English L1 speakers than the Sesotho speakers, which means that the L1 readers need not have spent as much time reading the subtitles as the L2 readers in order to understand what was being said.

With regards to absorption, the effects for reading comprehension were all small, but not all effects were significant. In terms of English subtitle reading, the effects were consistently bigger in favour of L1 reading. However, as the effects were not all significant and as they did not all measure in the hypothesized direction, these findings can be disregarded.

Correlations: Reading comprehension vs. Absorption parameters								
Group	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		r	p	r	p	r	p	
CEE	E	-0.1868	0.000	-0.2051	0.000	-0.1529	0.000	522
TSE & TES	E	-0.0976	0.019	-0.0315	0.449	0.0949	0.022	580

Table 5.22 Correlations between reading comprehension and all three parameters used to measure absorption.

The negative correlations found for reading comprehension and subtitle reading constitute a linear effect in the hypothesized direction, but because this was not found for all groups, reading comprehension failed the second criterion. Consequently, although reading comprehension correlated significantly with subtitle reading it does not account for the differences that were found.

The effects for reading comprehension and vertical movement were equally small as can be seen in Table 5.23.

Correlations: Reading comprehension vs. Vertical movement						
Group	Lang	Glances count		Revisitors count		N
		r	p	r	p	
CEE	E	0.1760	0.000	0.1409	0.001	522
TSE & TES	E	0.1810	0.000	0.1579	0.000	580

Table 5.23 Correlations between reading comprehension and the two parameters used to measure vertical movement.

Vertical movement was not analysed in more detail because it was not part of the primary focus of the study.

5.4.1.3 Conclusion

Based on the findings given above, reading speed and reading comprehension can be ruled out as confounding variables that might have influenced the eye-tracking data for subtitle reading. These two variables did have effects on subtitle reading, but not all effects were significant and not all effects measured in the hypothesized direction.

When considering the effect of **reading speed** on **subtitle absorption**, both negative and positive correlations were found. The positive correlations did not measure in the hypothesized direction and were disregarded. The negative correlations were expected and measured in the hypothesized direction. In other words, participants who read the static text faster generally spent less time reading the subtitles. This was found for all for groups except test groups TSE and TES for their reading of Sesotho subtitles, and was found in terms of all three parameters used to measure absorption (dwell time total, fixation time total and fixation count). A positive correlation was found for fixation count for control group CSS, but this was disregarded because it did not measure in the hypothesized direction. In general the correlations between participants' reading speed for static text and subtitle reading were very weak, suggesting that participants employed different reading strategies for reading static texts and subtitles. In addition to these weak correlations, the fact that some of the correlations were in opposite directions indicates that participants' reading speed for static text reading can be excluded as a confounding variable and predictor of participants' subtitle reading ability.

Overall positive and small correlations were found between **reading speed** and **vertical movement**, meaning that a faster reading speed in terms of words per minute resulted in more

vertical movements being made. Effects were bigger for the English control and test groups than for the Sesotho control and test groups, but the effects stayed small and never increased in size. The correlations were non-significant for Sesotho, and significant (but very weak) for English, indicating that participants' reading speed for static text reading can be excluded as a confounding variable and predictor of participants' viewing pattern for subtitle reading in terms of vertical movement.

In terms of the relation between the **reading speeds of static text and subtitle reading** negative correlations were initially found for both Sesotho and English reading. Upon closer analysis, however, it was found that the Sesotho speakers were not able to finish reading the Sesotho subtitles within the available presentation time. This was found for the reading of both one-line and two-line subtitles, although significantly more cases of unfinished reading were found for the reading of two-line subtitles. Consequently the calculated reading speeds for Sesotho subtitle reading were deemed invalid and were excluded from further analysis – a comparison between the actual reading speeds for Sesotho static text and subtitle reading could not be drawn and a relation between static text and subtitle reading could not be established. In terms of English static text and subtitle reading it was found that the English L1 speakers read both the English static text and English subtitles faster than the Sesotho L1 speakers, indicating an effect for L1 reading and that the Sesotho speakers' L2 English reading skills need to be improved in order to view subtitled programmes more optimally in terms of attention distribution.

Correlations between **comprehension scores** and **absorption** offered only small effects, but not all effects were significant and not all effects measured in the hypothesized direction. In terms of English subtitle reading, the effect was greater for the English L1 speakers than the Sesotho speakers, which means that the L1 readers need not have spent as much time reading the subtitles as the L2 readers in order to understand what was being said. However, because the findings did not all measure in the hypothesized direction, participants' comprehension score for static text reading can be excluded as a confounding variable and predictor of participants' subtitle reading ability. The same can be said of the correlations between **comprehension scores** and **vertical movement**.

Due to consistent, small effects for both reading speed and comprehension scores, both these variables can be excluded as confounding variables that offer possible explanations for the patterns found in the eye-tracking data of subtitle reading, namely that Sesotho and English

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

subtitles were read differently in general, and that the English L1-speaking participants in control group CEE consistently read the English subtitles much faster and easier than the Sesotho L1-speaking participants in test groups TSE and TES. Both these findings were found for the duration of the film. Furthermore, the variables passed the first of the three criteria (statistically significant effect) to varying extents, but offered varying findings in terms of the second (linear relation) within and across groups, some measuring in the hypothesized directions while others did not. This means that neither reading speed nor comprehension scores can be considered confounding variables that could offer alternative explanations for the findings.

5.4.2 Subtitle length

Subtitle word and character count were taken into consideration for the analysis. No distinction was made between one-line and two-line subtitles as it is obvious that a two-line subtitle contained more words and characters than a one-line subtitle.

5.4.2.1 Correlation between subtitle length and subtitle reading

A very strong, positive correlation was found between subtitle length and absorption.

Correlations: Word count vs. Absorption parameters								
Group	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		r	p	r	p	r	p	
CEE	E	0.6918	0.000	0.6528	0.000	0.7195	0.000	522
TSE & TES	E	0.7171	0.000	0.2810	0.000	0.7451	0.000	580

Table 5.24 Correlations between word count and all three parameters used to measure absorption.

Correlations: Character count vs. Absorption parameters								
Group	Lang	Dwell time total [ms]		Fixation time total [ms]		Fixation count		N
		r	p	r	p	r	p	
CEE	E	0.7294	0.000	0.6880	0.000	0.7540	0.000	522
TSE & TES	E	0.7394	0.000	0.2602	0.000	0.7660	0.000	580

Table 5.25 Correlations between character count and all three parameters used to measure absorption.

In other words, the longer a subtitle, the more time was spent processing that particular subtitle. This was found for all groups in terms of both word count (Table 5.24) and character count (Table 5.25). The overall correlation between word count and the amount of time spent in the subtitles (dwell time) was also high ($r = 0.61$). This finding was expected as it makes sense that someone would spend more time reading a subtitle (or any reading material) that contains more text. The correlations were statistically significant, and as the findings were expected, they measured in the hypothesized direction. However, the differences between the groups were very small – correlations were of equal strength. This agrees with the findings in Chapter 4. Therefore, although subtitle length correlated significantly with subtitle reading, the correlations were consistent for all groups and therefore do not explain the differences in subtitle reading.

Furthermore, no significant correlations were found between subtitle length and vertical movement – effect sizes were very small and insignificant for all groups ($r < 0,1$; $p > 0,05$). Vertical movement was not analysed in more detail because it was not part of the primary focus of the study.

5.4.2.2 Conclusion

Based on the abovementioned findings, subtitle length in terms of both word and character count can be ruled out as a confounding variable that explains the differences in the eye-tracking data for subtitle reading. Participants in all groups spent more time reading subtitles that were longer; the effect was therefore the same for all participants in terms of processing. In the case of vertical movement the lack of significance was also the same for all participants – the length of the subtitles did not affect the vertical movements of any of the participants in any of the groups. Subtitle length therefore cannot be held accountable for the deviations found in the eye-tracking data.

5.4.3 Questionnaire data

Data collected in the questionnaire was analysed in terms of two categories: participants' reading and television viewing habits, and participants' attitude toward reading subtitles. Participant demographics were not used for statistical analyses because of the lack of variance (cf. section 5.2).

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

Participants responded to questions on how much time was spent reading static text (Reading habit), reading subtitles (Subtitle reading habit) and watching television (Television viewing habit) in a week, and whether they liked watching local and imported soap operas. In terms of subtitle reading, participants were asked if they preferred to watch local and imported television programmes with or without subtitles, how often they read L2 subtitles (L2 subtitle reading habit) and whether they liked to read subtitles at all. Each variable is evaluated against the three criteria to see if it could explain the differences found in subtitle reading. In other words, the following three questions had to be asked:

- Did it have a significant effect on subtitle reading?
- If so, was the effect linear and in the hypothesized direction? (i.e. did it hold an advantage for subtitle reading?)
- If so, did it agree with the distribution pattern found for the observed difference in subtitle reading? (i.e. did the findings for each variable agree with the findings for subtitle reading?)

All three these conditions had to be satisfied for each of the variables individually in order for that variable to explain the differences found for subtitle reading. The findings for each of the variables are discussed in the sections to follow.

5.4.3.1 Reading habit

The regularity with which participants read static text was found to have a statistically significant effect for fixation time ($F(1, 2340)=18.070$, $p<0.05$) but not dwell time ($F(1, 2340)=0.15454$, $p>0.05$). However, despite this significant interaction, the relationship between reading and fixation time was not in the expected direction.

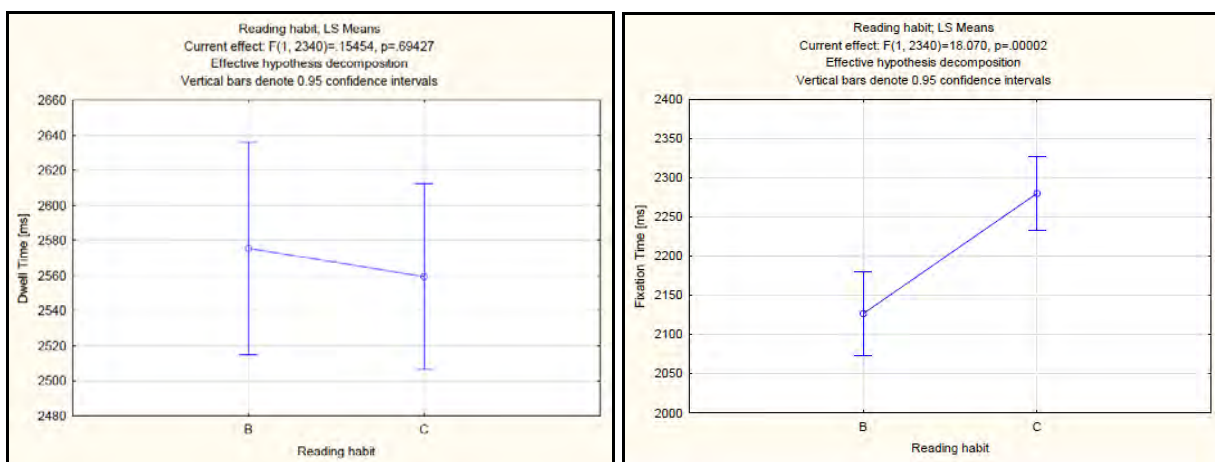


Figure 5.3 Graphs indicating the linear interaction of participants’ reading habit with dwell time (left) and the reversed linear interaction with fixation time (right).

The observed effect therefore provides no explanation for a possible pattern for dwell time and fixation time – participants who said they read the most (C) were found to spend more time fixating the subtitles but less time dwelling in the subtitled area, while participants who said they read moderately (B) were found to spend less time fixating the subtitles but more time dwelling in the subtitled area. These conflicting findings indicate that the reading habits of participants do not explain the difference in subtitle reading – although having passed the first criterion (statistically significant effect), this variable failed the second (linear relation). It therefore does not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2, nor does it account for the differences in L1 subtitle reading.

5.4.3.2 Subtitle reading habit

A significant effect was found for participants’ habitual reading of subtitles for both dwell time ($F(2, 2339)=11.922, p<0.05$) and fixation time ($F(2, 2339)=30.039, p<0.05$). For dwell time the effect was found to be linear, but in the unexpected direction. For fixation time the effect was found to be semi-linear, but also in the unexpected direction. In other words, instead of more regular reading of subtitles leading to the easier processing thereof (by spending less time reading the subtitles), the opposite pattern was found.

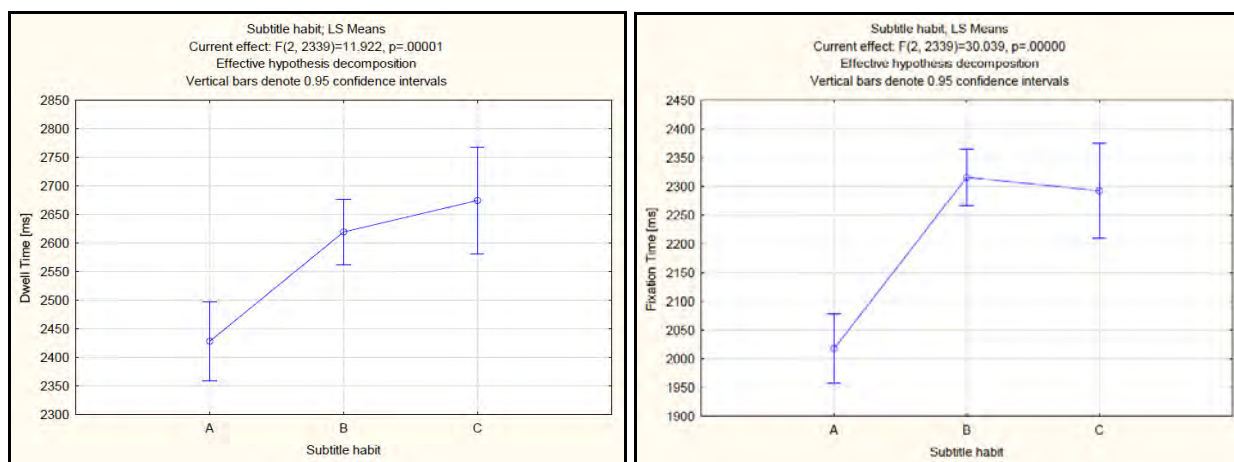


Figure 5.4 Graphs indicating the reversed linear interaction of participants’ subtitle reading habit with dwell time (left) and the semi-linear, reversed interaction with fixation time (right).

Participants who stated that they read subtitles on a regular basis (C) were found to spend the most time reading the subtitles, while those who stated they read very few (B) to no subtitles (A) were found to read and process the subtitles much quicker. This means that, despite having passed the first criterion (statistically significant effect), this variable failed the second (linear relation) and does not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2, nor does it account for the differences in L1 subtitle reading.

5.4.3.3 Television viewing habit

It was found that the television viewing habits of participants did have a statistically significant effect on subtitle viewing in terms of both dwell time ($F(2, 2339)=12.951, p<0.05$) and fixation time ($F(2, 2339)=7.0777, p<0.05$). However, despite the significant interaction, the relationship between television viewing and dwell time was not linear. In addition, the relationship between television viewing and fixation time was linear but in the unexpected direction – the more participants watched television per week, the more difficulty they had reading and processing the subtitles (by spending more time reading them).

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

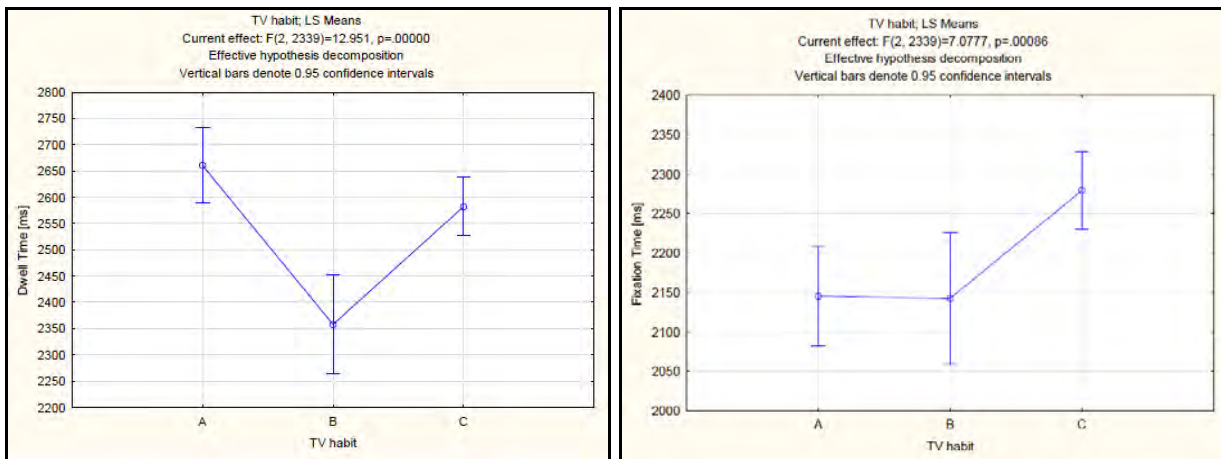


Figure 5.5 Graphs indicating the non-linear linear interaction of participants' television viewing habit with dwell time (left) and the reversed linear interaction with fixation time (right).

Despite having passed the first criterion (statistically significant effect), this variable failed the second (linear relation) and therefore does not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2, nor does it account for the differences in L1 subtitle reading.

5.4.3.4 Like to watch local soap operas

A significant effect was found for participants' liking of local soap operas in terms of both dwell time ($F(3, 2221)=10.894, p<0.05$) and fixation time ($F(3, 2221)=17.053, p<0.05$). However, although the effect was semi-linear, it was not in the expected direction – in terms of dwell time those who liked local soap operas the most (4) spent the most time reading the subtitles, while those who liked it least (1) spent the least time reading the subtitles. In terms of fixation time the effect was slightly different.

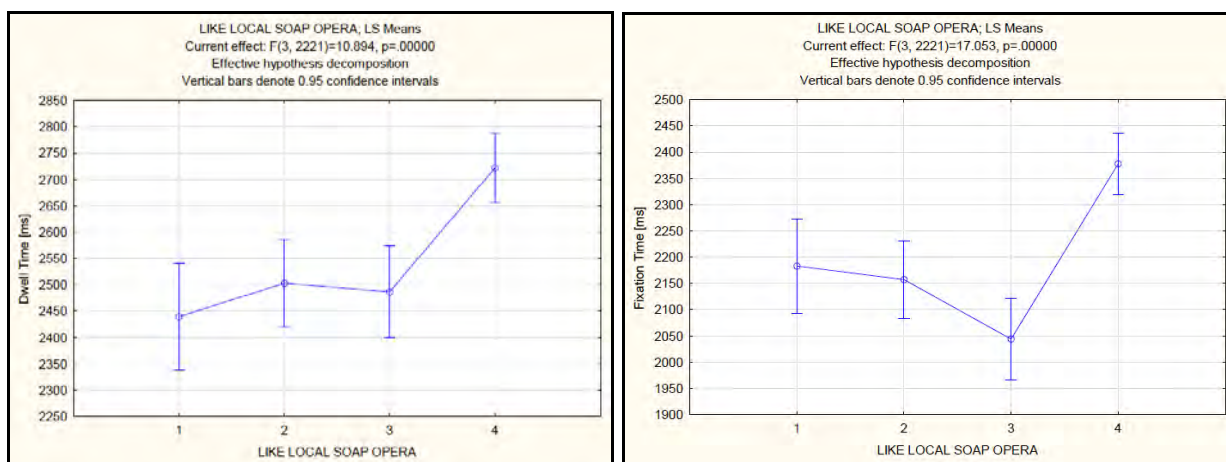


Figure 5.6 Graphs indicating the semi-linear, reversed interaction of participants’ liking of local soap operas with dwell time (left) and the non-linear interaction with fixation time (right).

Despite having passed the first criterion (statistically significant effect), this variable failed the second (linear relation) and does not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2, nor does it account for the differences in L1 subtitle reading.

5.4.3.5 Like to watch imported soap operas

Participants’ liking of imported soap operas was found to have a statistically significant effect for both dwell time ($F(3, 2217)=8.1532, p<0.05$) and fixation time ($F(3, 2217)=13.432, p<0.05$). However, despite this significant interaction, the relationship between the extent to which participants liked to watch imported soap operas and dwell time and fixation time was linear in the unexpected direction. As with local soap operas one would have expected that participants who liked to watch imported soap operas more would have read and processed subtitles more easily because this type of programming is prevalent on South African television.

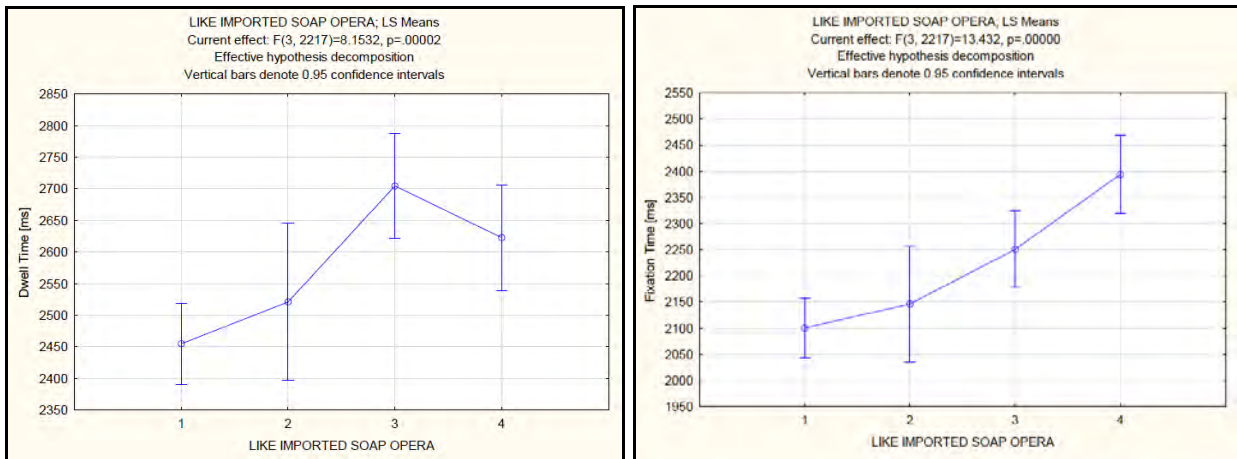


Figure 5.7 Graphs indicating the semi-linear, reversed interaction of participants’ liking of imported soap operas with dwell time (left) and the reversed linear interaction with fixation time (right).

Despite having passed the first criterion (statistically significant effect), this variable failed the second (linear relation). It therefore does not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2, nor does it account for the differences in L1 subtitle reading.

5.4.3.6 Prefer local television programmes with or without subtitles

Participants’ preference for watching local television programmes with or without subtitles was found to have a statistically significant effect for both dwell time ($F(1, 2340)=6.7687, p<0.05$) and fixation time ($F(1, 2340)=7.0627, p<0.05$). In both cases the relationship between participants’ preference for watching local television with or without subtitles and their subtitle viewing was found to be linear and in the hypothesized direction – participants who said they liked to watch local television with subtitles were found to read and process the subtitles more easily (by spending less time reading them).

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

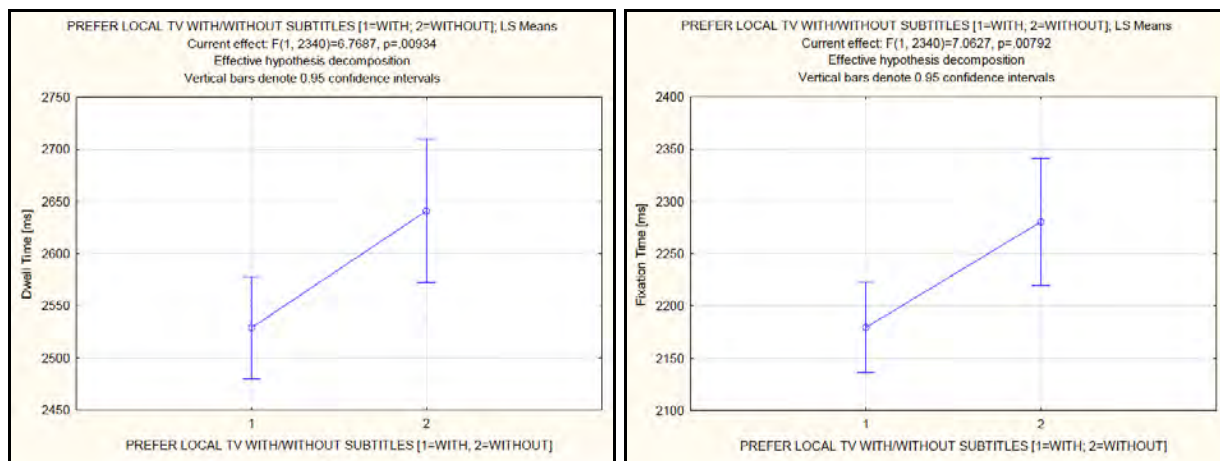


Figure 5.8 Graphs indicating the linear interaction of participants’ preference to view local television programmes with or without subtitles with dwell time (left) and fixation time (right).

This means that the differences that were found for subtitle reading might be due to the difference in participants’ preference for subtitles. This possibility may therefore provide an alternative account for the difference in L2 and L1 reading of English subtitles found throughout the entire film and also for the differences in the reading of L1 subtitles, but only if the following conditions were satisfied: if participants in CEE and preferred to watch imported television programmes with subtitles much more than participants in either of the test groups that read the L2 English subtitles (TSE and TES), and if the English L1-speaking participants in control group CEE showed a greater preference for subtitles than the Sesotho L1-speaking participants in test groups TSE and TES and control group CSS. None of these conditions were satisfied.

Prefer local television programmes with or without subtitles						
Rating	Dwell time [ms] (means)	Fixation time [ms] (means)	CSS	CEE	TSE	TES
1	2528.790	2179.357	5	7	7	7
2	2640.854	2280.358	5	2	3	3
All Groups				9	10	10

Table 5.26 Crosstabulations of participants’ preference to watch local television programmes with or without subtitles for the respective groups based on the number of subtitles read per participant. The means are also given for dwell time and fixation time per category rated from 1 (with subtitles) to 2 (without subtitles) as calculated by means of ANOVAs.

Participants in control group CEE showed the same preference for subtitles as test groups TSE and TES, which contradicts the first condition. Furthermore, because the English L1-speaking participants in control group CEE showed the same preference for subtitles as the Sesotho L1-speaking participants in test groups TSE and TES, the second condition is automatically

contradicted, even though the English L1-speaking participants in control group CEE showed a greater preference for subtitles than the Sesotho L1-speaking participants in control group CSS. By passing the first and second criteria (statistically significant effect and linear relation), participants' preference for watching local programmes with subtitles might have had an effect on subtitle reading, but because it failed the third (participant distribution), it does not explain the different eye-tracking findings for L1 and L2 reading of English subtitles. It therefore does not provide an alternative explanation to refute the research hypothesis that reading differs for L1 and L2, nor does it account for the differences in the reading of L1 subtitles.

5.4.3.7 Prefer imported television programmes with or without subtitles

Participants' preference for watching imported television programmes with or without subtitles did have a significant effect on their subtitle reading in terms of both dwell time ($F(1, 2340)=6.3903, p<0.05$) and fixation time ($F(1, 2340)=21.687, p<0.05$). However, in both cases the relationship between participants' preference for watching imported television with or without subtitles and their subtitle viewing was found to be linear in the unexpected direction – participants who said they liked to watch imported television with subtitles were found to read and process the subtitles with more difficulty (by spending more time reading them).

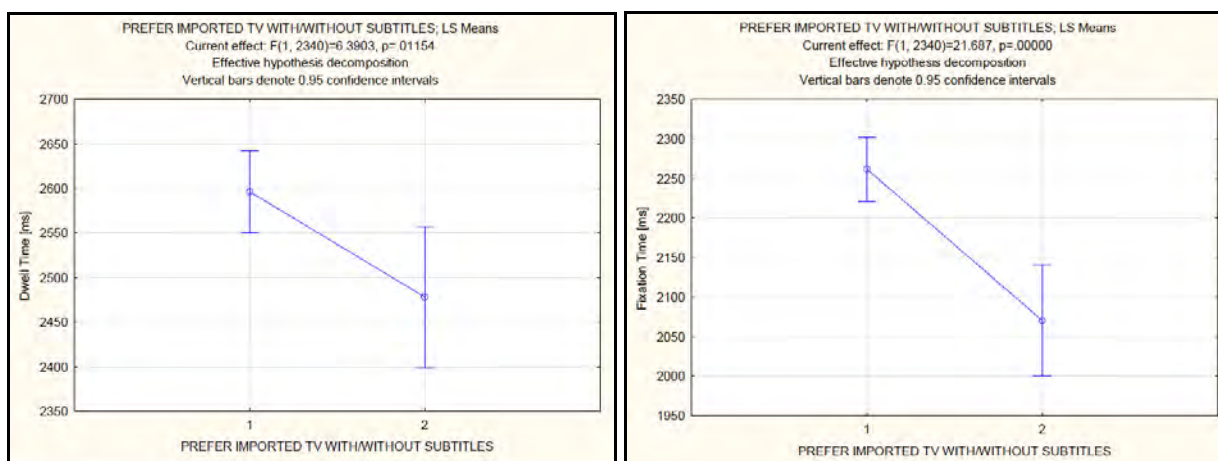


Figure 5.9 Graphs indicating the reversed linear interaction of participants' preference to view imported television programmes with or without subtitles with dwell time (left) and fixation time (right).

Despite having passed the first criterion (statistically significant effect), this variable failed the second (linear relation). It therefore does not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2, nor does it account for the differences in L1 subtitle reading.

5.4.3.8 L2 subtitle reading habit

A significant effect was found for participants' habitual reading of L2 subtitles for both dwell time ($F(3, 2338)=10.932, p<0.05$) and fixation time ($F(3, 2338)=40.940, p<0.05$). The effect found was linear, but not in the expected direction – instead of more regular reading of L2 subtitles leading to the easier processing thereof (by spending less time reading the subtitles), the opposite pattern was found.

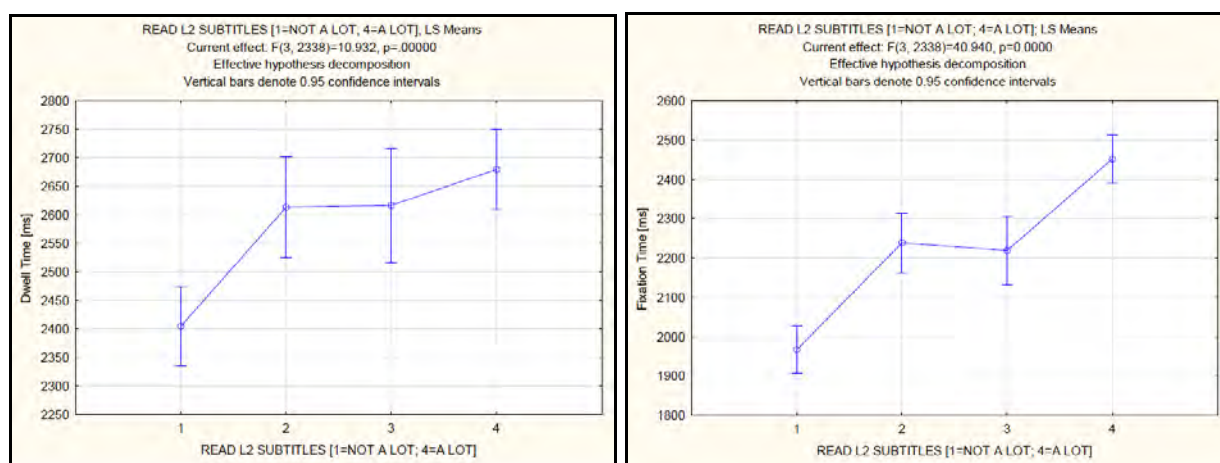


Figure 5.10 Graphs indicating the reversed linear interaction of participants' L2 subtitle reading habit with dwell time (left) and fixation time (right).

Participants who stated that they read L2 subtitles on a regular basis (4) were found to spend the most time reading the subtitles, while those who stated they read no subtitles (1) were found to read and process the subtitles the quickest. However, despite having passed the first criterion (statistically significant effect), this variable failed the second (linear relation). It therefore does not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2, nor does it account for the differences in L1 subtitle reading.

5.4.3.9 Like to read television subtitles

The regularity with which participants read subtitles on television was found to have a statistically significant effect for dwell time ($F(3, 2215)=21.371, p<0.05$) and fixation time ($F(3, 2215)=40.776, p>0.05$). However, in both instances the relationship found was not linear.

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

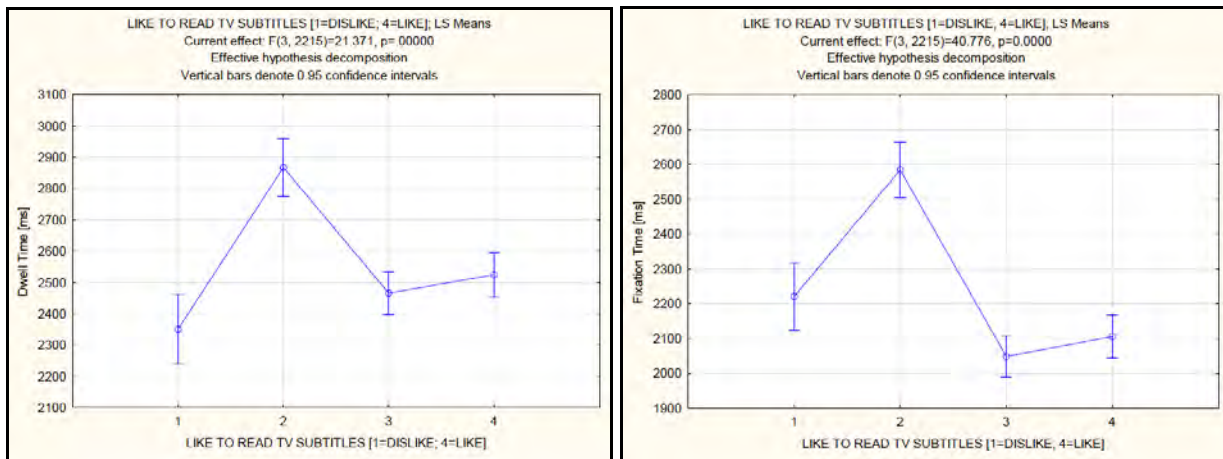


Figure 5.11 Graphs indicating the non-linear interaction of participants' liking of television subtitles with dwell time (left) and fixation time (right).

Despite having passed the first criterion (statistically significant effect), this variable failed the second (linear relation). It therefore does not provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2, nor does it account for the differences in L1 subtitle reading.

5.4.3.10 Conclusion

As mentioned earlier, the potential confounding variables passed the three criteria to a varying extent. However, in the end none offered a valid justification to support an alternative hypothesis that the differences observed for subtitle reading could be attributed to factors other than L1 and L2 reading as can be seen in Table 5.27 below. In addition, none of these variables offered an alternative explanation for the differences in L1 subtitle reading.

Summary of findings for alternative hypotheses				
	Criterion 1	Criterion 2	Criterion 3	
Variable	Significant effect [Y/N]	Linear relation [Y/N]	Participant distribution [Y/N]	Provides competing alternative account to research hypothesis [Y/N]
Reading speed	Y	N		N
Reading comprehension	Y	N		N
Subtitle length	Y	Y	N	N
Reading habit	Y	N		N
Subtitle reading habit	Y	N		N
Television viewing habit	Y	N		N
Like to watch local soap operas	Y	N		N
Like to watch imported soap operas	Y	N		N
Prefer local television programmes with or without subtitles	Y	Y	N	N
Prefer imported television programmes with or without subtitles	Y	N		N
L2 subtitle reading habit	Y	N		N
Like to read television subtitles	Y	N		N

Table 5.27 Summary of the findings for the additional variables. Each variable represents the possibility of an alternative hypothesis that could refute the research hypothesis that subtitle reading differs for L1 and L2.

Although conducted on a different scale, the three-year panel study by Koolstra *et al.* (1997) in which they measured television's impact on children's reading comprehension and decoding skills also examined the effects of television viewing, viewing frequency for entertainment and informational programmes, subtitle reading, book reading and reading attitude (although in this case the effects were measured for the children's improvement in their reading and decoding skills of static text). For children in both age groups that were tested, reading comprehension was found to correlate negatively with the total amount of television viewing, the viewing frequency of entertainment programmes and subtitle reading (most correlations with subtitle reading were not statistically significant) (Koolstra *et al.*, 1997:140). Furthermore, reading comprehension was

found to correlate positively with the viewing frequency of informational programmes (though mostly non-significantly) (*ibid.*). No significant correlations were found for decoding skills and the television viewing measures (total amount of viewing and viewing frequency of entertainment and informational programmes), but decoding skills did correlate positively with subtitle reading, especially for the older children (*ibid.*). Lastly, Koolstra *et al.* (1997) found that, for both age groups tested, reading and comprehension skills correlated significantly and positively with book reading, reading concentration and reading attitude (Koolstra *et al.*, 1997:140).

Correlations of this nature between the different influencing variables were not of particular or immediate relevance to the current study, but might be considered for future research.

5.5 CONCLUSION

The aim of this chapter was to present and discuss the results of the analyses and all other empirical findings of the Sesotho experimental component of this study in an attempt to explain the difference(s) found in the reading of L1 and L2 subtitles, as well as the differences found in the reading of L1 subtitles as measured by means of eye tracking. Confounding variables as gathered from the questionnaire and the reading of static text were also considered in order to explore possible alternative explanations for the patterns found in the reading of subtitles that might refute the hypothesis that subtitle reading differs for L1 and L2, and also in order to support the notion that the differences in L1 subtitle reading are attributed to low literacy levels as a result of participants' socioeconomic background and history.

In the analysis of the eye-tracking data for subtitle reading two main findings emerged: there were significant differences in the reading of English subtitles when read as L1 and L2 text, and there were significant differences in how L1 subtitles were read by the Sesotho L1 and English L1 speakers. Both these effects were much greater than was reported for Afrikaans and English subtitle reading in Chapter 4 – whereas the Sesotho speakers in both test groups TSE and TES consistently read the English subtitles significantly slower than the English L1 speakers throughout the entire film, a significant difference was only found for one Afrikaans test group (TAE) and only during the second half of the film. Furthermore, the difference between the reading of Sesotho and English subtitles was much greater than the difference between the reading of Afrikaans and English subtitles. This difference was ascribed to the fact that the

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

Afrikaans speakers are much more used to reading in both their L1 and English as their L2. L1 reading skill is the key differentiating factor here – Afrikaans speakers generally do much more L1 reading than Sesotho speakers, for whom very little Sesotho reading material is available. It was also found that the Sesotho L1-speaking participants generally spent more time reading the subtitles, whether the subtitles were in Sesotho or English, than did the English L1-speaking participants. More specifically, the Sesotho L1-speaking participants in both the test groups (TES, TSE) and the control group (CSS) spent more time overall reading the two-line subtitles than the English L1-speaking participants. There were no significant differences in the reading of Sesotho subtitles.

In terms of vertical movement, the number of glances and revisits made by the Sesotho L1-speaking participants when reading English subtitles were found to differ significantly from those made by the English L1-speaking participants – significantly fewer glances were made by the Sesotho speakers. There were also significant differences between the number of glances and revisits made when reading Sesotho and English subtitles in general – significantly fewer glances and revisits were always made when reading Sesotho subtitles. An interesting finding, however, was that for test group TSE, who read Sesotho subtitles during the first half of the film and English subtitles during the second, there was almost no difference in viewing pattern for reading Sesotho and English two-line subtitles in terms of vertical movement. In contrast to the findings for one-line subtitles, test group TSE did not show an increase in the number of glances and revisits made to the subtitles when shifting from reading Sesotho subtitles during the first half of the film to reading English subtitles during the second half. In this regard the viewing pattern of test group TSE was in agreement with that of the other Sesotho L1 speakers who read Sesotho subtitles, and not with the viewing pattern of the English L1-speaking participants in control group CEE who read English subtitles.

Whereas there were no significant differences in the reading of Sesotho subtitles, there were significant differences in the reading of English subtitles for the duration of the film. Possible explanations for this included the following:

- (1) That there is a difference for L1 and L2 subtitle reading.
- (2) That test groups TSE and TES perhaps consisted of slower readers and that their reading speed could have influenced their subtitle reading.

- (3) That the English L1-speaking participants perhaps read more, watched more television and read subtitles more regularly than the Sotho L1-speaking participants, which might cause them to read and process subtitles more easily.

The **first possibility** constitutes the research hypothesis of this study. All other options were explored in order to find something that might offer an alternative explanation to refute or at least cast doubt on the research hypothesis.

The **second possibility** was affirmed by the findings for participants' reading of static text, but was ruled out as a confounding variable by the results for correlations between reading speed and subtitle reading. Participants in test groups TSE and TES were indeed found to read the static text slower than participants in control group CEE in terms of English reading. Control group CEE read the fastest overall, followed by test group TES and then test group TSE for their reading speed for English. Following this was test group TES, then control group CSS, and lastly test group TSE for their reading speed for Sesotho reading. There was therefore an overall difference in reading speeds for English and Sesotho reading, with English reading being consistently faster than Sesotho reading. Test group TSE had the slowest reading speeds for English and Sesotho respectively. In terms of the correlations, reading speed did correlate significantly with the reading of subtitles overall, but the effects were consistently weak and not always in the hypothesized direction. The pattern for participant distribution therefore did not agree with all the differences observed in the subtitle reading. Because all three criteria were not satisfied, reading speed was not found to provide an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2.

Reading speed did, however, offer additional insights into the overall reading ability of the participants – there was a big overall effect in terms of L1 reading and general reading ability that can be ascribed to low literacy levels as a result of participants' socioeconomic background, educational opportunities and other aspects of their history. Correlations between the reading speeds for static text reading and subtitle reading could not be performed for Sesotho reading because it was found that the Sesotho speakers were not able to finish reading the Sesotho subtitles within the available presentation time. The probable explanation for this is that Sesotho speakers in general are not used to reading in Sesotho and that reading Sesotho subtitles, with all the additional complexities that go with it, was therefore too demanding for them to process in

the available display time. The implication here is that Sesotho speakers need more and continual exposure to L1 reading in order to improve their overall reading ability for Sesotho reading. The same can be said of their reading of L2 English, because although the Sesotho speakers read the English static text and subtitles faster than the Sesotho static text and subtitles, their English reading is still not optimal – in terms of static text reading the Sesotho speakers' comprehension was better for reading in Sesotho despite reading much slower than in English; in terms of subtitle reading the Sesotho speakers still spent a disproportionate amount of time reading the English subtitles despite reading them much faster (and complete) than the Sesotho subtitles. The implication here is that if people were to read subtitles faster without compromising their level of comprehension, they would spend less time in the subtitled area than was found for the current study and their attention would be distributed more optimally between the subtitled text and the rest of the visuals on-screen.

Participants' answers to the questionnaire were used to explore the **third possibility** listed above. ANOVAs on participants' reading habit, subtitle reading habit, television viewing habit, their liking of local and imported soap operas, their preference for subtitled television programmes, their L2 subtitle reading habit and their general liking of subtitles did show significant interactions with their reading of subtitles, but the interaction did not go beyond having had a general effect. These variables passed the first two of the three criteria (statistically significant effect and linear relation) to various extents, but in none of the cases were all three criteria passed (cf. Table 5.27, section 5.4.3.10). Therefore none of these possible confounding variables offered an alternative explanation to refute the research hypothesis that subtitle reading differs for L1 and L2. In addition, none of these variables offered an alternative explanation for the differences in L1 subtitle reading.

In conclusion, the analysis failed to find support for confounding variables that might explain the differences in the reading of English subtitles. Therefore no alternative explanation was found to refute the research hypothesis that subtitle reading differs for L1 and L2. There might of course be other aspects that could have influenced participants' subtitle reading, but for the purpose of the current study the hypothesis is therefore supported: it is more difficult to process English subtitles when read as L2 text than when read as L1 text. In addition, the analysis found that there is an inherent difference in subtitle reading based on the L1 of the participants that can be attributed to overall low levels of literacy as a result of participants' socioeconomic background and history – the Sesotho speakers, who hail from different historical, linguistic, cultural and

Chapter 5: Analysis and interpretation of empirical findings for Sesotho L1 speakers

socioeconomic backgrounds than the English L1 and Afrikaans L1 speakers who were also examined in the current study, were found to read not only the L2 English, but also the L1 Sesotho text and subtitles much slower and with more difficulty. Literacy is therefore the bigger issue at play and needs to be addressed before people will be able read and benefit from subtitles optimally.

The next chapter discusses the relevance of these findings for subtitling in South Africa as well as recommendations for the exploration of further research avenues.

CHAPTER 6

Conclusions and recommendations

6.1 INTRODUCTION

Currently, most South African subtitles are in English. As English is not spoken as the first language by the majority of the population, these subtitles are predominantly received as second language text. The purpose of this study was to determine whether there were any differences in L1 and L2 subtitle reading. In the first chapter the following research questions were formulated:

- Are there differences between L1 and L2 subtitle reading among Afrikaans L1, English L2 participants?
- Are there differences between L1 and L2 subtitle reading among Sesotho L1, English L2 participants?
- What are the implications of the findings for the improvement of subtitling in South Africa for these language groups, and how do the findings affect the creation and implementation of future guidelines aimed at aiding the production of L2 subtitles in South Africa?

Eye tracking has proven to be a valuable method to study reading. Yet previous research on the eye movements for L1 and L2 subtitle reading specifically and the insights to be gained from such research is very limited. Furthermore, to date no such research has been conducted on the reading of subtitles in South Africa. The purpose of the study was to present the uses of eye-tracking technology as a means to study the efficiency of L2 subtitles within the multilingual and multicultural South African environment. This study comprised a literature review on the use of eye tracking to study reading as well as an empirical study.

In this chapter an overview is given of the findings for the two components of the current study as discussed in Chapters 4 (Afrikaans L1 speakers) and Chapter 5 (Sesotho L1 speakers), followed by a discussion of the results in accordance with the above-mentioned research questions. The limitations of the current study are also discussed along with recommendations for future research.

6.2 OVERVIEW OF THE STUDY

In Chapter 1 the limitations of subtitling in South Africa was discussed in terms of language, accessibility and issues of literacy and readability (Kruger, H.C., 2004; Kamwangamalu, 2007), emphasising the notion of reading English as a second language (Bernhardt & Kamil, 1995; Brisbois, 1995; Coetzee-Van Rooy & Verhoef, 2000) and the difficulties associated with especially the reading of second language subtitles (Chai & Erlam, 2008). From this the core of the research issue emerged: how effective are L2 subtitles in South Africa, and how do people differ in their reading of L1 and L2 subtitles?

A first step was taken in the current study to address these issues by studying the reading of Afrikaans L1-speaking students and Sesotho L1-speaking students when reading subtitles in Afrikaans (L1), Sesotho (L1) and English (L2). It was decided to make use of Afrikaans L1-speakers for the first part of this study because much is known about the reading of the people who comprise the group – Afrikaans L1-speaking children are, from a young age, afforded the opportunity to learn and develop their Afrikaans and English skills, forming a solid basis in the prior before learning the latter, and thus developing their proficiency in both these languages. In Chapter 1 this was referred to as the “well-known phenomenon of Afrikaans/English bilingualism” (Coetzee-Van Rooy, 2010a:15) where speakers have a high level of proficiency in Afrikaans and English as their second language to the extent that they are near or fully bilingual.

The same relationship does not exist between African languages and English for users of these languages, as the manner in which the languages are acquired differ completely – speakers of African languages might receive initial educational instruction in their home language, but the language of teaching is often very quickly switched to English. In other words, children who speak an African language are seldom granted the opportunity to fully learn to read and write in their L1 before moving on to learning these skills in an L2 or another additional language (Matjila & Pretorius, 2004; Pretorius & Mampuru, 2007; Pretorius & Currin, 2010). If this other language is English, the increasing attention causes the children to become more skilled in English than their home language, while at the same time neglecting the learning of proper reading in both. As Matjila and Pretorius (2004:2) argue:

Chapter 6: Conclusions and recommendations

It is indeed an undisputed fact that language and reading are closely related; if one has little or no proficiency in a language, one can obviously not read with understanding in that language. However, the relationship between language proficiency and reading is asymmetrical: being proficient in a language does not guarantee that one can read in that language. Language ability is necessary for reading but not sufficient; reading is a unique ability that must be acquired and practised through extensive exposure to written language.

African languages were therefore excluded from the first part of the current study as the extent of the additional variables and complexities were too intricate for a first trial to gather basic data on the difference between L1 and L2 reading. Instead it was examined for the second part of the study once comparable data had been collected and analysed for Afrikaans mother-tongue speakers. In this way the data for the Afrikaans L1 speakers' reading of subtitles in their L1, Afrikaans, and English as their L2 could be used as baseline findings for the sake of comparison.

It was decided to make use of eye-tracking technology because of its reported usefulness in monitoring reading behaviour and indicating processing difficulty. Chapter 2 presented a comprehensive overview of the uses and findings of previous eye-tracking studies on reading and the reading of subtitles. From this overview it was determined that participants' processing difficulty could be measured by the number and duration of fixations made (Just & Carpenter, 1980; Praet *et al.*, 1990; McConkie & Yang, 2003; Morris & Williams, 2003; Liversedge *et al.*, 2004; d'Ydewalle & De Bruycker, 2007; Perego, 2008; SMI, 2009b), that people differ in their allocation of attention between the subtitled area and the rest of the screen (Perego, 2008; SMI, 2009a), and that when presented with subtitles, people tend to read them automatically and usually tend to the written text first before looking at the rest of the visuals on the screen (d'Ydewalle *et al.*, 1991; De Bruycker & d'Ydewalle, 2003; Steinberg, 2004; d'Ydewalle & De Bruycker, 2007; Schmidt-Weigand, 2009).

The benefits and drawbacks of subtitling were also discussed in Chapter 2. The benefits of subtitling usually centre on the fact that it offers access to foreign films or material, but were also found to pertain to language learning and acquisition, usually within an educational environment (Koolstra *et al.*, 1997; Koolstra & Beentjes, 1999; Koolstra *et al.*, 2002; Danan, 2004; Caimi, 2006; Chai & Erlam, 2008). The drawbacks of subtitling are typically cited as increased attentional demand on the viewer which often coincides with the loss of information in one of the channels, and that it detracts from the overall viewing experience (Guillory, 1998; Danan, 2004). Chapter 2 also cited gaps in previous eye-tracking research and limitations of findings, of

Chapter 6: Conclusions and recommendations

which the lack of eye-tracking research focused on the reading of L1 and L2 subtitles was the most important for the motivation for the current study. As mentioned in Chapter 2, there have been numerous studies on the reading of L2 subtitles, but usually in terms of language acquisition. Eye-tracking research, in turn, has focused more on the reading of L1 and foreign language subtitles (Pavakanun, 1992; De Bruycker & d'Ydewalle, 2003; Van Lommel *et al.*, 2006; d'Ydewalle & De Bruycker, 2007), and although there have been findings for the reading of L1 and L2 subtitles (Caimi, 2006; Chai & Erlam, 2008; Perego, 2008), this section of the research field is not as well-represented as others. The most obvious gap in the research is the notable absence of research on the efficiency of subtitles in South Africa.

The current study set out to address this gap by using eye tracking to study people's reading of English L2 subtitles, as this is the norm for subtitle presentation in South Africa. The experimental part of the current study consisted of three components – the reading of static text, the viewing of a subtitled short film, and the completion of a questionnaire on reading behaviour and preferences. The first two components were completed with the use of an SMI iViewX™ Hi-Speed eye tracker. Participants were tested individually and were first given static text to read, followed by the completion of a comprehension test on the text to ensure reading for content occurred. This was followed by the viewing of a French animated short film that was subtitled into Afrikaans, Sesotho and English. Participants were divided into test and control groups and based on the group allocation read the static text in Afrikaans, Sesotho or English, or in a combination of either Afrikaans or Sesotho and English, completed a comprehension test on the text(s) in the respective languages, and viewed the film with Afrikaans, Sesotho or English subtitles or in a combination of either Afrikaans or Sesotho and English. The questionnaire was issued to participants after the eye tracking had been completed to ensure that participants were not biased toward the nature and purpose of the experiment. The gathered data was analysed for statistical effects by means of ANOVAs, t-tests, correlations and crosstabulations in Statistica in order to comment on L1 and L2 subtitle reading.

6.3 SUMMARY OF FINDINGS

The findings will be discussed in terms of Afrikaans L1 speakers (Chapter 4) and Sesotho L1 speakers (Chapter 5) separately as well as combined to indicate the specific as well as general findings of this study. The findings will then also be discussed in terms of the research questions

that were formulated in Chapter 1 to conclude the discussion of the overall findings of this study and the implications thereof in the South African context.

6.3.1 Summary of findings for Afrikaans L1 speakers

In Chapter 4 it was shown that there were statistically significant differences in L1 and L2 subtitle reading for Afrikaans L1-speaking participants. This was found in terms of processing, but was not found for all the groups. Apart from the findings for one of the Afrikaans test groups, the differences were mainly small and/or insignificant. However, these findings refute the null hypothesis (H_0) that there is no difference in subtitle reading in and between the different groups.

The only significant differences in reading were found for test group TAE who read Afrikaans subtitles during the first half of the film and English subtitles during the second half of the film – when the language changed from Afrikaans to English, participants in this group took significantly more time to read the English L2 subtitles than did the English L1 participants in control group CEE. It should be noted here, however, that this was the only significant difference in the reading of English subtitles and was found for one test group and during one half of the film only. In general there was therefore a great degree of similarity in the way in which the subtitles were read by the different L1 speakers across the different groups. Another finding was that, overall, the Afrikaans L1 participants spent more time reading the subtitles (whether they were Afrikaans or English) than did the English L1 participants. However, the research hypothesis (H_R) that the differences in subtitle reading could be attributed to L1 and L2 reading could not yet be supported – confounding variables first had to be analysed to see whether they offered alternative competing explanations for the findings (H_A).

It was found that all Afrikaans L1-speaking participants spent more time reading two-line than one-line subtitles, and that the time needed for processing increased proportionally with an increase in the number of words in the subtitle(s). Subtitle length and participants' reading speed were ruled out as influencing variables, however, because the respective positive and negative correlations were expected and consistent across all four groups. Furthermore, subtitle length and reading speed did not pass all three the criteria used to measure whether variables offered justifiable alternative explanations for differences found for subtitle viewing (statistically significant effect, linear relation and participant distribution), which means that they cannot

Chapter 6: Conclusions and recommendations

account for the differences found in the eye-tracking data. These findings refute the alternative hypothesis (H_A) that subtitle reading differs because of a confounding factor and not L1 and L2 reading.

It was also found that the differences in subtitle reading could not be attributed to confounding variables related to participants' reading habits and/or preferences as gathered from participants' completed questionnaires. More specifically, whether participants differed in their static text reading, television viewing and subtitle reading habits and/or preferences did not explain the differences found for L1 and L2 subtitle reading in the eye-tracking data. The specific variables that were analysed measured whether participants:

- read more static text,
- watched more television,
- read subtitles more regularly,
- preferred to watch more or less local and/or imported soap operas,
- preferred to watch local and/or imported television programmes with or without subtitles,
- read L2 subtitles more regularly, and
- liked to read subtitles in general.

These variables did have significant effects on participants' subtitle reading, but upon closer examination these effects were not consistent and/or linear in terms of their relation to patterns found in the data. The patterns for the eye-tracking data and the influence of the confounding variables did not correlate – the variables did not coincide with the division for CEE, TAE in such a way that CEE's faster reading of the subtitles could perhaps be explained by the fact that they read, watched television, and read subtitles (and L2 subtitles specifically) considerably more often than TAE, and preferred to watch soap operas, preferred subtitles and in general liked to read subtitles considerably more than TAE. Furthermore, participants' reading speed and level of comprehension measured for the reading of static text prior to their viewing of the subtitled film did not display a correlation with the eye-tracking data for L1 and L2 subtitle reading either. These confounding variables were analysed in an attempt to refute the research hypothesis that L1 and L2 subtitle reading differs, but ultimately this hypothesis was not refuted by any of the additional variables. The conclusion to be drawn from the current study is therefore that some

participants inherently read differently when reading subtitles in their L1 and L2. The research hypothesis is therefore supported.

6.3.2 Summary of findings for Sesotho L1 speakers

In Chapter 5 it was shown that there were more statistically significant differences in L1 and L2 subtitle reading for the Sesotho L1-speaking participants than for the Afrikaans L1-speaking participants. Furthermore, unlike for the Afrikaans L1-speaking participants, there were also statistically significant differences in the overall reading of L1 Sesotho and L1 English subtitles. This was found in terms of processing as measured across the two control and two test groups that read Sesotho only (CSS), English only (CEE), Sesotho-English (TSE) or English-Sesotho (TES) subtitles respectively. These findings refute the null hypothesis (H_0) that there is no difference in subtitle reading in and between the different groups.

In terms of the differences in L1 and L2 subtitle reading it was found that the Sesotho L1-speaking participants took significantly more time to read the English L2 subtitles than did the English L1-speaking participants in control group CEE. In contrast to the findings for Afrikaans and English subtitle reading, this was found throughout the entire film and for both the test groups. This behaviour was also found in the vertical movement of test groups TSE and TES in their reading of English and Sesotho subtitles in the respective halves of the film. However, although the Sesotho L1 speakers did not read the English subtitles as easily as the English L1 speakers, they still read the English subtitles easier than the Sesotho subtitles. This was also found throughout the entire film and for both the test groups. In this regard the findings for the Sesotho L1 speakers differ greatly from the findings for the Afrikaans L1 speakers – for the Afrikaans L1 speakers differences in the reading of English L2 subtitles were found for one test group only, and when comparing their reading of English L2 subtitles to their reading of Afrikaans L1 subtitles, the differences were much smaller and less significant than for the Sesotho L1 speakers. In addition, when comparing the Sesotho L1 speakers and the Afrikaans L1 speakers in terms of their reading of the English L2 subtitles, it was found that the Sesotho L1-speaking participants took significantly more time to read the English L2 subtitles than did the Afrikaans L1-speaking participants.

It was also found that the way the Sesotho L1 speakers read the Sesotho subtitles differed significantly from the way the English L1 speakers read the English subtitles – the English L1

Chapter 6: Conclusions and recommendations

speakers were much more proficient in their reading of L1 subtitles than the Sesotho L1 speakers. In fact, it was found that the Sesotho L1 speakers were not able to finish reading the Sesotho subtitles within the available presentation time. This was found for the reading of both one-line and two-line subtitles, although significantly more cases of unfinished reading were found for the reading of two-line subtitles. These findings all point to a very big underlying issue that can be ascribed to participants' socioeconomic background and history: literacy. Due to the lack of available educational and general reading materials in Sesotho and because of an educational system where Sesotho speakers are not afforded the opportunity learn in their L1, the Sesotho speakers are not equipped with the necessary reading skills to read proficiently in their L1, Sesotho. Instead, they develop a greater proficiency in their L2, English. This is clear from the findings for both subtitle and static text reading, where the Sesotho L1 speakers consistently read the English text and subtitles faster than the Sesotho text and subtitles.

Despite this, participants were found to have benefited more from L1 reading in terms of comprehension – the Sesotho L1 speakers scored better in the comprehension tests for Sesotho reading than English reading. The implication of this is that, if Sesotho speakers were afforded the opportunity to develop and optimise their L1 reading skills, they would not only read faster, but also better. The same can also be said of their reading in English, because although the Sesotho L1 speakers read faster in English, their English reading was still not optimal. It was found that, overall, the Sesotho L1-speaking participants spent more time reading the subtitles (whether they were Sesotho or English) than did the English L1-speaking participants. This difference was not as dramatic for the Afrikaans L1 and English L1-speaking participants.

The analysis of possible confounding variables did not offer a competing account for the differences found in subtitle reading and the aforementioned findings in terms of literacy. In terms of subtitle length, all participants spent more time reading two-line than one-line subtitles, and the time needed for processing increased proportionally with an increase in the number of words in the subtitle(s). This was to be expected and subtitle length was consequently ruled out. Possible confounding variables related to participants' reading habits and/or preferences as gathered from the completed questionnaires were also ruled out because whether participants differed in their static text reading, television viewing and subtitle reading habits and/or preferences did not explain the differences found for subtitle reading. This agrees with the findings for Afrikaans and English subtitle reading as was reported in Chapter 4.

Chapter 6: Conclusions and recommendations

The conclusion to be drawn from this component of the current study is therefore that, based on the respective L1s of the participants, participants inherently read differently when reading subtitles in their L1 and L2. The research hypothesis is therefore supported.

6.3.3 Discussion of overall findings and implications

When comparing the findings for the Afrikaans L1-speaking and Sesotho L1-speaking participants it becomes clear that there is much more to L1 and L2 reading than simply the difference in L1 and L2 reading. The greater significance lies in the reasons as to why participants read the way they do, and why their reading differs in the different languages.

In terms of the static text reading, the Afrikaans L1-speaking participants read the Afrikaans text much faster than the Sesotho L1-speaking participants read the Sesotho text. The probable reason for this is that Afrikaans speakers, from an early age, do much more L1 reading than Sesotho speakers because of the limited availability of Sesotho reading material. In addition to doing more L1 reading at school, Afrikaans speakers are also encouraged to read more at home – in Afrikaans households there is a greater emphasis on reading and therefore a bigger culture of reading and literacy. Compared to the reading of the English static text, the Afrikaans L1-speaking participants read the Afrikaans text slightly faster than the English text, whereas the Sesotho L1-speaking participants read the English static text much faster than the Sesotho text. This can be ascribed to the fact that the Afrikaans L1 speakers are almost equally exposed to reading in both Afrikaans and English, with Afrikaans, their mother-tongue, still being the stronger language of the two. Sesotho L1 speakers, in turn, are exposed to reading in English from an early age much more frequently than (often instead of) reading in Sesotho. In contrast to the Afrikaans L1 speakers, the Sesotho L1 speakers therefore experience English L2 reading as more familiar than L1 reading, which for them is an almost unknown practice. Nevertheless, the Afrikaans L1 and English L1 speakers both read the English text faster than the Sesotho L1 speakers, indicating overall differences in literacy.

When comparing the comprehension scores of the Afrikaans L1 and Sesotho L1-speaking participants, a different effect was found than for reading speed: the Afrikaans L1 participants read the Afrikaans static text faster than the English static text and generally scored better marks for their Afrikaans reading. The Sesotho L1 participants, however, despite reading the English static text much faster than the Sesotho static text, generally scored better marks for their

Chapter 6: Conclusions and recommendations

Sesotho reading. In terms of comprehension both these groups therefore benefited more from reading in their mother-tongues than in English as a second language. For the Sesotho L1 participants this furthermore indicates that faster reading does not necessarily imply better reading.

In terms of the subtitle reading the Afrikaans L1-speaking participants read the Afrikaans L1 subtitles easier than the Sesotho L1-speaking participants read the Sesotho L1 subtitles – the Sesotho L1 participants consistently spent more time reading the subtitles than the Afrikaans L1 speakers. This is due to the fact that Afrikaans speakers, from an early age, do much more L1 reading than Sesotho speakers because of the limited availability of Sesotho reading material. However, both groups read the L2 English subtitles better and faster than the subtitles in their L1 – for the Afrikaans L1 speakers this is because Afrikaans subtitles are unknown and unfamiliar to them; for the Sesotho L1 speakers this is because Sesotho static text reading is already a strange experience, let alone reading Sesotho subtitles where they have to read the Sesotho subtitled text within a limited time frame and while having to simultaneously view and comprehend the rest of the visuals on the screen.

The Afrikaans L1-speaking participants did not read the English L2 subtitles much differently than the Afrikaans subtitles because they grew up in an environment where reading in both these languages were taught and encouraged from an early age. The Sesotho L1-speaking participants read the English L2 subtitles completely differently than the Sesotho subtitles because they do much more English reading than Sesotho reading in general, and because they are used to seeing English subtitles on television but not Sesotho subtitles. However, when comparing the findings for English L2 subtitle reading as read by the Afrikaans L1 and Sesotho L1 participants, it was found that the Sesotho L1 participants spent more time reading the English L2 subtitles than the Afrikaans L1 participants. Only one parameter indicated a different finding for two-line subtitle reading – the Afrikaans L1 participants spent more time fixating the two-line subtitles during the second half of the film than the Sesotho L1 participants. The differences found for the reading of English L2 subtitles as read by the Afrikaans L1 and Sesotho L1 speakers can be attributed to the fact that, although the English L2 subtitles were easier to read than the Sesotho L1 subtitles, for the Sesotho L1-speaking participants English is still a second language. In Chapter 1 (cf. section 1.3), it was stated that Afrikaans L1 speakers have a high level of proficiency in both L1 Afrikaans and English as their second language to the extent that they are near or fully bilingual. In other words, for most Afrikaans L1 speakers English can almost be considered a ‘second first

Chapter 6: Conclusions and recommendations

language'. As was mentioned before, the same cannot be said for Sesotho L1 speakers (or for any other language spoken in South Africa) – because they are never afforded the opportunity to learn, develop and perfect their L1 reading skills at school and from an early age, there is no safety net and no solid foundation for their learning of English as is the case for Afrikaans L1 speakers (Pretorius & Machet, 2004; Pretorius & Ribbens, 2005; Pretorius & Mampuru, 2007; Pretorius & Currin, 2010).

These findings cannot be considered in isolation and have to be discussed with regards to the context of the overall study, the central theoretical statement and the research questions. The research questions can therefore be answered as follows:

(1) Are there differences between L1 and L2 subtitle reading for Afrikaans L1 speakers?

Statistically significant differences were found for L1 and L2 subtitle reading in terms of the processing of the subtitles. It was found that the Afrikaans L1 speakers in one of the two experimental groups read and processed the Afrikaans subtitles more easily than the English L2 subtitles, and when reading English L2 subtitles, they needed more time to process the subtitles than did the English L1 speakers who read the exact same subtitles. However, this difference was slight as it was only found for one of the two test groups and only during one half of the film. Nevertheless, the Afrikaans L1-speaking participants therefore read Afrikaans subtitles the easiest, followed by their L2 reading of English subtitles, both of which were trumped by the English L1-speaking participants' reading of L1 subtitles. These findings were based on the eye-tracker's automatic capturing of data for dwell time (the total amount of time spent in the subtitled area) and fixation time (the total sum of fixation durations within the subtitled area).

The way in which participants viewed the subtitles also varied, as the English L1 speakers were found to be more interactive in shifting their attention to and from the subtitles than were the Afrikaans L1 speakers, but this does not necessarily relate to processing and was attributed to the L1 of participants (whether they were Afrikaans or English) rather than to L1 versus L2 subtitle reading, although some variance was found in this regard.

(2) Are there differences between L1 and L2 subtitle reading for Sesotho L1 speakers?

Statistically significant differences were found for L1 and L2 subtitle reading in terms of the processing of the subtitles – this was found for the reading of English subtitles as L1 and L2 text, as well as for overall L1 (Sesotho) as opposed to L2 (English) subtitle reading. It was found that the Sesotho L1 speakers in both the experimental groups read and processed the Sesotho subtitles with more difficulty than the English L2 subtitles, and when reading English L2 subtitles, they needed more time to process the subtitles than did the English L1 speakers who read the exact same subtitles. The Sesotho L1-speaking participants therefore experienced the most difficulty reading Sesotho subtitles and read the English L2 subtitles much quicker. In fact, it was found that the Sesotho speakers were not able to finish reading the Sesotho subtitles within the available presentation time. The probable explanation for this is that Sesotho speakers in general are not used to reading in Sesotho and that reading Sesotho subtitles, with all the additional complexities that go with subtitle reading in general, was therefore too much for them to process. The English L1-speaking participants' in control group CEE read and processed the English subtitles the quickest of all the groups, significantly quicker than the Sesotho L1 speakers for both their English and Sesotho subtitle reading. These findings were based on the eye-tracker's automatic capturing of data for dwell time (the total amount of time spent in the subtitled area) and fixation time (the total sum of fixation durations within the subtitled area).

The way in which participants viewed the subtitles also varied, as the English L1 speakers were found to be more interactive in shifting their attention to and from the subtitles than were the Sesotho L1 speakers, but this does not necessarily relate to processing and was attributed to the L1 of participants (whether they were Sesotho or English) rather than to L1 versus L2 subtitle reading, although some variance was found in this regard.

(3) (a) What are the implications of the findings for the improvement of subtitling in South Africa for these language groups?

Based on the findings of the study that Afrikaans L1 speakers in only one of the two test groups took slightly longer to read and process the English subtitles than the Afrikaans subtitles and that they did not read the Afrikaans and English subtitles that much differently in general, the conclusion to be drawn is that reading English subtitles does not pose a problem for speakers of

Chapter 6: Conclusions and recommendations

this language group, despite English being their second language. However, if they were more exposed and more used to reading Afrikaans subtitles, their reading speed may pick up, leading to more optimal subtitle reading and subtitle viewing in general. In addition, they will have the added benefit of increased comprehension, the effect that was found for their L1 reading of static text. This being said, the Afrikaans L1 speakers will not have any problems processing the English subtitles on public television. However, as the relationship between Afrikaans speakers reading in Afrikaans and English is unique in the South African context, this cannot necessarily be said of other language groups – there are no other groups of balanced-bilinguals in South Africa to which the same measures could be directly applied. Even the reversed condition would not necessarily yield the same findings – English L1 speakers are typically more proficient in their L1 than L2, the difference being much greater than the relation between L1 and L2 for Afrikaans L1 speakers. Consequently the suggestion to present Afrikaans L1 speakers with L1 rather than English L2 subtitles as is the case in the current study can be made much more easily than for any other language combination in South Africa.

The findings for the Sesotho L1 speakers in the current study prove this point with statistical significance – because of the lack of available reading material in Sesotho and the overall lack of exposure to reading in Sesotho, the Sesotho L1 speakers consistently look much longer to read and process the Sesotho subtitles than the English subtitles. This follows as a natural conclusion after having found that they read the Sesotho static text much slower than they read the English static text – subtitle reading places much more constraints on the reader, as reading is but one of three events that have to occur simultaneously in order to comprehend all that is offered: reading, watching, and listening. Furthermore, although findings indicate that the Sesotho L1 speakers understood the Sesotho static text better than they understood the English static text, one cannot assume that they would understand the Sesotho subtitles better – because of their low reading speeds for Sesotho and because of the fleeting nature of subtitles (being visible for short amounts of time only) the Sesotho L1 speakers will not have enough time to read the subtitles, meaning that they will not have gathered all the information they need before proceeding to the reading of the next subtitle. If this happens consistently throughout the subtitled programme there will be a total loss of meaning. Presenting Sesotho L1 speakers with L1 subtitles is therefore not a viable option.

In comparison to the other participants that took part in the current study, the literacy levels of the Sesotho L1-speaking participants are low, especially given the fact that they represent the

Chapter 6: Conclusions and recommendations

upper end of their community in terms of education and literacy. Therefore, even if Sesotho L1 speakers were to be exposed to Sesotho subtitles more regularly, it would take much longer for Sesotho subtitles to be read quickly enough by the average Sesotho speaker for them to harness the benefits thereof in terms of comprehension – although their comprehension for Sesotho reading is better, their reading speed is so low that English remains the better option at present. Only if Sesotho speakers were otherwise exposed to Sesotho reading and Sesotho reading materials in print much more often would subtitles in Sesotho be useful and beneficial.

The findings of the current study therefore indicate that, although reading Afrikaans subtitles was easy, the reading of L2 subtitles was not that much more difficult for the Afrikaans L1 speakers. Thus, given the slight advantage (on a larger scale) that participants are used to reading English L2 subtitles due to continual exposure, English subtitles remain a serviceable alternative for this specific user group – if L2 subtitles were to be improved somewhat, people might benefit from them more. On the other hand, however, it should be kept in mind that the initial sample group used for this study was a unique group in terms of their shared proficiency between Afrikaans and English – if they struggled somewhat with the reading of L2 subtitles, other groups might struggle even more.

In contrast to the reading of Afrikaans and English subtitles, for the Sesotho L1 speakers reading Sesotho subtitles proved to be much more difficult than reading English subtitles. However, their reading of the English subtitles was not optimal either – they read the English subtitles much slower than the Afrikaans L1 speakers, and therefore also much slower than the English L1 speakers. In comparison, English subtitles are therefore the better alternative at present. Nevertheless, saying that improved L2 subtitles might make people benefit from them more is not the only solution here – the problem reaches beyond the mere improvement of subtitles and touches on the much bigger issue of literacy and the implications thereof for the creation of subtitles that can be read and understood optimally by the viewing public.

(b) How do the findings affect the creation and implementation of future guidelines aimed at aiding the production of L2 subtitles in South Africa?

Empirical findings showed that participants spent a disproportionate amount of time reading the subtitles and spent very little time looking at anything else. This is not the ideal way of viewing subtitles and contradicts the purpose for which subtitles are displayed. The purpose of subtitling

Chapter 6: Conclusions and recommendations

is to make the information and message accessible to those people who do not understand the language of the original dialogue or who do not have access to the audio channel at all (e.g. Deaf or hard-of-hearing viewers). However, the subtitled text itself is not the only means by which the message is conveyed. On the contrary – it is an additive element which is meant to enhance the viewing experience in total. What is shown to the audience through the filmic composition and the use of various filmic elements is of great importance, and both the film or programme viewed and the viewer are done a great injustice if the subtitles are the only elements attended to. As was stated in Chapter 2, subtitled film and television material are polysemiotic compositions where more than one semiotic channel is used to carry across a message or specific meaning (Gambier, 2006b; Sokoli, 2006). By only reading the subtitles, the full scope of the intended meaning is therefore not obtained. As Hajmohammadi (2004) states, “[m]ovie-viewers go to theaters or sit in front of TVs to *watch*, not to *read*.”

One way of reducing the amount of time spent in the subtitles is to reduce the amount of words (text) in the subtitles. In other words, one has to reduce or condense the subtitled text for viewers in such a way that enough of the message is retained and still conveyed effectively. The issues of condensation and the need for brevity are topics of considerable discussion in subtitling research (Gottlieb, 1994:273). Gottlieb (*ibid.*) motivates the need for brevity based on three factors: “the immediate nature of subtitling” (tempo of speech, scene editing and cutting); “intersemiotic redundancy” (one’s ability to gather information from the different semiotic, audiovisual channels); and “intrasemiotic redundancy” (one’s ability to interpret the dialogue based on the content, the way it is spoken and the characteristics of the speaker).

It was mentioned in Chapter 4 that previous studies in Belgium found that participants spent 37% of their viewing time reading one-line subtitles, 45% reading two line subtitles, and a total of 41% reading subtitles in total. Gottlieb comments on similar studies conducted earlier, saying that 55.4% spent reading two line subtitles justifies speeding up normal subtitling and disregarding the six-second rule of subtitling (corresponding to approximately 180 wpm) because viewers have almost half of their viewing time available to view the rest of the visuals on the screen (Gottlieb, 1994:274). This might be justifiable, but the question arising from this is what should the allowed or prescribed distribution of attention be? How should the time spent reading the subtitles and viewing the rest of the visuals be divided? There are no guidelines on this issue and no set values for the optimal distribution of attention. There is, however, a growing concern regarding this matter among some scholars. From the findings of a broader eye-tracking

Chapter 6: Conclusions and recommendations

project conducted in the UK, Romero-Fresco (forthcoming, 2011) argues for a distinction between reading speed for static text reading and subtitle reading in favour of what he has coined ‘viewing speed’ – as opposed to reading speed which refers to only the reading of the subtitled text itself, viewing speed takes into account “the amount of time devoted to image and subtitles” (Romero-Fresco, forthcoming, 2011:24). Preliminary findings have been reported, but the research is still ongoing. In both components of the current study the amount of time allocated to the reading of one-line (58% and 70%), two-line (70% and 79%) and overall subtitles (67% and 76%) by participants seems too great (cf. Tables 4.2, 4.3, 5.2 and 5.3), and rather suggests the opposite of Gottlieb’s notion – participants spent too much time reading and too little time viewing and absorbing the filmic visuals, and therefore the amount of text should be reduced rather than increased in order to facilitate both reading and overall filmic viewing.

Clearly the six-second rule of subtitling does not seem adequate for the sample group used for the current study and needs to be examined for a larger, more representative group in order to see if it is adequate for the South African viewing public in general. However, based on what is known about the reading ability of South Africans, it is unlikely that any other segments of the population will do better in this regard.⁴⁹ European audiences might be able to disregard this standard because they are much more familiar with the reading of subtitles⁵⁰ and consequently read subtitles much quicker, but one cannot say the same for South African audiences. The current study proved this quite clearly – the sampled participants in the Sesotho component of this study were often unable to finish reading the Sesotho subtitles and spent a disproportionate amount of time in the subtitled area for both Sesotho and English subtitle reading. Given that the sample was drawn from a tertiary institution, the participants represent the higher end of society in terms of education and literacy. The implication of this is that the information load will have

⁴⁹ The national matriculation pass rate is estimated to have dropped from 62.5% in 2008 to 60.7% in 2009 (Motshekga, 2010). When narrowing the focus to the reading of African languages specifically, the situation is just as complex. According to the 2001 census data, “only 5.2% of the Black population in South Africa have post-school qualifications, while a further 16.8% have completed secondary education (Statistics South Africa 2004: 37).”

⁵⁰ Familiarity with subtitles (also called “habit formation”, d’Ydewalle *et al.* 1991:660) is a much debated issue. One would think that people who are more used to reading subtitles will read it quicker and spend less time in the subtitled area. d’Ydewalle *et al.* (1991) see this as the other way around. The fact that American participants were found to look proportionally more at the subtitles than the Dutch participants was used, amongst other things, as a basis to negate the influence of habit formation (d’Ydewalle *et al.* 1991:660) – the Dutch participants, being more familiar with subtitles, are supposed to read the subtitles more automatically.

Chapter 6: Conclusions and recommendations

to be lowered considerably in order for the average Sesotho speaker to be able to read the subtitles while being able to view the rest of the visuals on the screen.

Guidelines therefore need to be set in place to ensure the equal distribution of attention between the subtitled area and the rest of the screen. Romero-Fresco (forthcoming, 2011:23), in discussing the debate of verbatim versus edited subtitles, comments on the convention of reading speed as currently applied to subtitling by stating the following:

At the centre of this controversy is the notion of **reading speed**, which supporters of verbatim subtitles push to 180wpm. In contrast, those who prefer edited subtitles recommend lower speeds of approximately 150wpm. The problem in this case is that this concept of reading speed does not come from subtitling, but from psycholinguistics, where it has always been applied to print reading. Useful as it may be, its application to subtitling should account for the audiovisual nature of this new medium, which has so far never been the case. (emphasis in original)

For Romero-Fresco (*ibid.*) the distinction between reading speed for static text and subtitle reading is based on the fact that, for static text reading, the reader chooses his/her pace of reading whereas for subtitle viewing, the reading speed is predetermined by the subtitler. It is also argued that a reading speed, as for example 180 wpm as prescribed by the six-second rule, might coincide with accurate and adequate subtitle reading, but not with overall subtitled filmic viewing (Romero-Fresco, forthcoming, 2011:24). Hence the new concept, 'viewing speed'. Romero-Fresco's preliminary findings for different viewing speeds and the corresponding subtitle versus image viewing can be seen in Table 6.1.⁵¹

Viewing speed	Time on subtitles	Time on images
120wpm	±40%	±60%
150wpm	±50%	±50%
180wpm	±60-65%	±40-35%
200wpm	±80%	±20%

Table 6.1 Preliminary findings for the distribution of attention between the subtitled area and the rest of the images (visuals) on the screen as found for different viewing speeds, taken from Romero-Fresco (forthcoming, 2011:24).

⁵¹ Regardless of the limitations of these preliminary findings as acknowledged by Romero-Fresco in the study itself, the findings are of great value as it shows that conventions are not timeless and need to be constantly retried and retested to ensure accuracy and validity. A reading speed of 150 wpm is clearly more adequate for overall viewing than the accepted norm of 180 wpm as viewers are granted more proportionate opportunity for subtitle and image viewing. However, Romero-Fresco (forthcoming, 2011:24) warns that subtitles should not be presented too slowly as this would lead to the re-reading of the subtitles, which often causes frustration and annoyance.

Chapter 6: Conclusions and recommendations

These findings are similar to the findings of the current study and clearly indicate the need for reconsideration of adequate subtitle presentation rates. In the current study, the Afrikaans L1 speakers were found to have read the English L2 subtitles at an average reading speed of 214 wpm (cf. Table 4.20) and on average spent 67% of their viewing time reading these subtitles (cf. Table 4.3). In order to facilitate a more equal distribution of their time (i.e. 50% reading, 50% viewing the images), the reading speed would have to be lowered to 160 wpm, which implies that the amount of text will have to be reduced considerably. For the Sesotho L1 speakers the implications are even more severe – they were found to have read the English L2 subtitles at an average reading speed of 197 wpm (cf. Table 5.20) and on average spent 74% of their viewing time reading these subtitles (cf. Table 5.3). In order to facilitate a more equal distribution of their time (i.e. 50% reading, 50% viewing the images), the reading speed would have to be lowered to 133 wpm, which implies that the amount of text will have to be reduced even more than for the Afrikaans L1 speakers. In comparison, the English L1 speakers read the English L1 subtitles at an average reading speed of 236 wpm (cf. Tables 4.20 and 5.20) while they spent 62% of their viewing time reading these subtitles (cf. Table 5.3). In order to facilitate a more equal distribution of their time (i.e. 50% reading, 50% viewing the images), the reading speed would have to be lowered to 190 wpm, which implies that the amount of text will have to be reduced as well, but not as much as for either the Afrikaans L1 or Sesotho L1 speakers.

Actual versus optimised reading and viewing speeds				
L1 speakers	Actual reading speed	Actual time on subtitles	Optimal viewing speed	Optimal time on subtitles
English	236 wpm	62 %	190 wpm	50 %
Afrikaans	214 wpm	67 %	160 wpm	50 %
Sesotho	197 wpm	74 %	133 wpm	50 %

Table 6.2 Suggested optimised viewing speeds for the equal distribution of attention between the subtitled area and the rest of the images (visuals) on the screen based on the findings of the current study.

A closely related issue is that of literacy. As was stated in Chapter 1, the South African illiteracy rate was estimated at 12% in 2009 (Human Development Reports, 2009). Literacy levels are particularly low in the more disadvantaged South African schools (Pretorius & Machet, 2004; Pretorius & Ribbens, 2005; Pretorius & Mampuru, 2007; Pretorius & Currin, 2010), although it is also noted that “low adult literacy levels are widespread throughout South Africa” (Pretorius and Ribbens, 2005:144). This could be the very determining factor that sets the South African

Chapter 6: Conclusions and recommendations

viewing public apart from its European counterparts. However, the issue of illiteracy is not only a factor in South Africa. Gambier (2006a:6) comments on this matter as follows:

But there is still no research on the possible correlation between viewing or reading of subtitles and the absence of illiteracy in a given society. Channels like TV5, BBC4 and TV4 nevertheless offer their audiences (intralingual) subtitles, irrespective of the degree of mastery of the language concerned.

Yet if subtitles are presented correctly and consistently, it could be a valuable tool used to improve literacy across the nation (Kothari *et al.*, 2002; Kothari, 2008). Subtitles were considered an aid for language learning as early as 1998 (and even earlier) when Ivarsson and Carroll stated that “subtitles are also being used to revive and teach minority languages, improve mother-tongue literacy, teach a country’s official language, and promote foreign language competency” (Ivarsson & Carrol, 1998:2). Since then countless studies have been conducted on the use of subtitles in educational environments (cf. section 2.4.3). Ayonghe (2009:57-62) makes specific reference to the benefits for beginner readers, foreign immigrants’ improvement in their reading of English, high school ESL students, below-average readers as well as bilingual students. However, besides these ‘usual suspects’ that benefit from subtitles as an aid to language learning, Ayonghe specifically makes note of adult learners:

[...] Bean and Wilson (1989), and Gillespie (1981) [...] demonstrated respectively that subtitling could improve the sight vocabulary of adult literacy students and provide reinforcement for new vocabulary in the second language class by providing a context for its use.

(Ayonghe, 2009:58)

This is an important point to take note of for the South African context – everyone can benefit from subtitles, young or old; subtitles will help develop the reading capabilities of people across the board. In addition, the fact that subtitled programmes employ more than one semiotic channel may also aid reading comprehension in general – the on-screen visuals reinforce and relate to what is written in the subtitles, thus acting as a springboard for understanding. Therefore, the more people are exposed to subtitling and the more they read subtitles, the more these skills will improve over time (Koolstra *et al.*, 1997; Ayonghe, 2009). Ayonghe (2009:142) came to the following conclusion:

Chapter 6: Conclusions and recommendations

The first part of the hypothesis of this study was that exposure to subtitled programmes over an extended period will improve AL [academic literacy] levels of tertiary students in Cameroon, and that it would be possible to develop a model for harnessing this mode as an integrated aid in such programmes. This part of the hypothesis that was supported by the findings of a pilot study has been confirmed by the results obtained here.

This correlation was not found in the current study, most likely because students had to report on their use of subtitling in a questionnaire and it was not directly observed over a period of time as was the case with Ayonghe's study. Through detailed empirical research, Ayonghe found that "[t]he results of the study showed with statistically and practically significant improvement that it was as a result of exposure to subtitled material that the students improved their AL [academic literacy] abilities." (Ayonghe, 2009:143). A series of studies conducted on the use of same language subtitling (SLS) with song-based television programmes on public television in India (Kothari *et al.*, 2002; Kothari *et al.*, 2004; Kothari, 2008) similarly found that continual exposure to this entertainment-based (non-academic) form of reading significantly improved viewers' reading skills and that this form of subtitling can be used to increase the extremely low national literacy levels.

Above all, these benefits of subtitling are reason enough to argue for accurate and efficient L2 subtitles in South Africa. Gambier (2006a:6) claims the following in this regard:

Certainly, if we could demonstrate that programs and films with interlingual or intralingual subtitles help viewers not only to maintain or even reinforce their ability to read but also to learn foreign languages (assimilating foreign sounds, expressions or accents), I am sure certain TV broadcasters and film distributors would pay more attention to subtitling and the working conditions of the subtitlers.

This is yet to be addressed in South Africa. The benefits of subtitling are known, but the challenge still facing South Africa is to ensure that subtitling is indeed correct, accurate, efficient and accessible to all. One way to do so is to create and implement guidelines for the presentation of subtitles; guidelines that take into account all the various considerations mentioned above. In this regard, the main findings of this study need to be reiterated and emphasised:

- (1) Literacy is a bigger issue than L2 reading.
- (2) L2 reading is almost as good as L1 reading if equal and adequate opportunity for L1 reading is given in education (Chapter 4 – Afrikaans L1 and English L2 reading).

Chapter 6: Conclusions and recommendations

- (3) L2 reading is even better than L1 reading if the language-in-education policy privileges the L2 (Chapter 5 – Sesotho L1 and English L2 reading).
- (4) Slow reading speed for static text reading transfers to subtitle reading, leading to a disproportionate amount of time being spent in the subtitled area (cf. Tables 4.3, 4.20, 5.3 and 5.20).

The primary recommendation at this point would be to address the low levels of national literacy urgently and aggressively – people do not have equal access to all public domains, not only because of inequality in terms of language use, but because they are not equipped with the necessary reading skills to make use of the information that is given to them. To use very basic imagery this could be described as putting people in a room with multiple doors leading to the outside, but not given them any keys.

Based on the findings for more optimised viewing speed (cf. Table 6.2) and that participants were found to spend less time reading one-line than two-line subtitles, and also given the fact that people with low literacy levels constitute the majority of the viewing public, a second recommendation would be to present one-line subtitles rather than two-line subtitles where feasible to facilitate not only reading, but also viewing and comprehension as a whole.

A third recommendation that can be made here relates strongly to the first recommendation mentioned above – in terms of equal access to public domains, subtitling as such is not necessarily the best solution for the majority of African language speakers that make up the South African viewing public. Generally slow reading speeds and poor comprehension indicate that severe textual reductions are needed in order for the viewers to be able to finish reading the subtitles within the available presentation time. This means that the information given to them will need to be reduced considerably, already leading to initial information loss, and even then it is not guaranteed that they will finish reading in time and be able to comprehend the given message as a whole. The recommendation would therefore be to rather give the viewers aural access to vital information whereby the information is presented orally in the different languages, as is currently the case with the public news broadcasts. Only when literacy levels are improved will subtitling truly be a viable solution.

The first step in all this would be to determine the true reading speeds and literacy levels of the different user groups that make up the South African viewing public. By doing this, research can

be continued on optimised subtitle presentation rates in order to truly make media accessible to all the different user groups.

6.4 LIMITATIONS

Although a difference was found for L1 and L2 reading of English subtitles, there were a number of limitations to the study.

The first limitation was regarding sample and sample size. The sample size was relatively small – after having excluded inaccurate data sets, the sample consisted of only 69 participants in total. However, when compared to other eye-tracking studies on subtitle reading, this is fairly normal. Three of the most prominent studies that focused on viewing behaviour and eye movements (Praet *et al.*, 1990; d’Ydewalle *et al.*, 1991; and d’Ydewalle & De Bruycker, 2007) used 16, 26 and 20 participants respectively. Similarly, the studies focused on reading (Vitu *et al.*, 1995; Rayner & Fischer, 1996; Liversedge *et al.*, 2004; and Nuthmann & Engbert, 2009) made use of 24, 40, 32 and 46 participants, all of which were students. The eye-tracking studies on language acquisition and vocabulary learning (Koolstra *et al.*, 1997; Koolstra & Beentjes, 1999; Koolstra *et al.*, 1999; and Van Lommel *et al.*, 2006) typically had larger samples ranging up to 828 participants because they measured and compared different groups of children of different ages, usually over longer periods of time.⁵² A number of studies on subtitle reading do not even report the sample size. Although the sample size used in the current study is therefore not really small in comparison to most previous studies of the same nature, to be able to make more accurate generalizations about the difference in L1 and L2 subtitle reading, a much larger sample size would be needed, especially for the English control group who only accounted for 9 of the 69 participants in this study.

A second limitation was related to the measurement of external variables such as participants’ reading speed for static text, reading habits, television viewing habits or their liking of subtitles in the questionnaire. More specific, reliable results would have been obtained from asking the participants more specific, detailed questions about their reading and subtitle viewing habits. For example, in the current study it was broadly asked how many times per week participants read

⁵² The scope of these experiments and the effects measured sets it apart from the current study and therefore sample sizes are not comparable.

Chapter 6: Conclusions and recommendations

subtitles on television or in films; the more specific alternative would have been to ask them to list the specific programmes they watched during a specific week. This could even form part of an additional component to the study in which participants are given a take-home survey to complete on a day-to-day basis for one or even two weeks or more. In this way one would get a much more accurate account of the participants' actual viewing and reading habits. Thus by extending the time-frame from one experiment session taking place on one day to an extended survey taking place over a week's time or more, more detailed responses could be obtained.

A third limitation pertained to the experimental material, specifically the text(s) for the static text reading component. As was reported in Chapters 4 and 5, the data gathered for participants' static text reading was used for the calculation of reading speed and comprehension only. Although these global measures were very important for the current study, additional detailed analyses of participants' reading could have been performed had it not been for inaccurate data recording by the eye tracker. One possible explanation for this could be that the texts were too long and too dense in terms of the number of lines displayed and that the line spacing in between the lines were too small, which might have skewed the data recording by not plotting participants' gaze on the right line or the right position.

A fourth limitation was that the number of one-line and two-line subtitles differed between the groups. This did not affect the data or findings, but more accurate generalizations could have been drawn across the seven groups if these values were the same.⁵³

A fifth limitation was the lack of in-depth questions about the participants' comprehension of the subtitled short film based on what was read in the subtitles. The importance of this was realised during the Sesotho component of the study especially – it became evident that the participants were unable to finish reading most of the Sesotho subtitles and that they were consequently not getting all the information they needed to understand the short film as a whole. Participants had given correct answers as to the overall meaning and moral of the story, but additional questions about things that were mentioned in the subtitles only and could not be deduced from simply looking at the visuals on the screen would have given additional insights into participants' true

⁵³ The number of one-line and two-line subtitles for Afrikaans and Sesotho subtitles were identical because the Afrikaans subtitles were translated into Sesotho with the specific instruction to keep the number of lines the same. The reason for this was so that the overall number of lines in the Afrikaans and Sesotho components of this study would be identical and thus exactly comparable.

Chapter 6: Conclusions and recommendations

understand of what had been said in the subtitles and whether they had actually read the subtitles with sufficient comprehension.

The sixth and final limitation of this study was the conditions for subtitle viewing – the fact that participants were sitting upright in front of the eye-tracking column with their chins and foreheads resting against rests, looking at a computer screen from a short distance, could have impacted on their viewing behaviour (i.e. how they looked at the subtitles). By contrast to a natural, relaxed environment, the viewing conditions were therefore fairly artificial. The difference in viewing behaviour under these different conditions thus becomes another avenue for further research.

6.5 RECOMMENDATIONS FOR FUTURE RESEARCH

The findings of this study have led to interesting insights and some basic questions pertaining to the differences in L1 and L2 subtitle reading have been answered, but further avenues need to be explored.

- The scope of a study on the reading of L2 subtitles needs to be broadened to include more of the African languages spoken in South Africa. The current study was only the starting point on this issue – Afrikaans speakers were chosen for the first component because there were limited extenuating variables influencing the participants' inherent linguistic and reading capabilities; Sesotho speakers were chosen for the second component because they constitute the largest student population on the campus where the study was conducted and also because it is one of the most prominent African languages spoken in South Africa. The research cannot stop here, however – the speakers of African languages are vastly underrepresented in terms of linguistic accessibility in the public domains. A good starting point would be to examine the subtitle reading of isiZulu speakers reading subtitles in isiZulu and English. isiZulu, the mother-tongue of 24% of the South African population, is the only African language that is truly represented in the public domain in terms of reading materials. According to an article published in the *The Taipei Times* (Anon., 2011) the Zulu press has a long history in South Africa – titles like *Ilanga* (the Sun) and *Um-Afrika* (the African) have been published in KwaZulu-Natal for more than a century. In 2002 another newspaper was added to this list, *Isolezwe*, which has since risen to the ranking of “South Africa’s third-most popular paper” (*ibid.*). According to *SouthAfrica.Info* (2011), “*Isolezwe*

Chapter 6: Conclusions and recommendations

is the premier isiZulu newspaper, published Mondays to Fridays. The paper has also launched the first Zulu-language website in the world. It is owned by the Independent Newspaper Group.” Isoleswe’s circulation numbers are estimated at 99 100, with a readership of approximately 655 000 (*ibid.*). It also has a weekly Sunday edition, Isoleswe nge Sonto, with circulation numbers estimated at 48 000 (*ibid.*). Isoleswe’s strongest competitor is Ilanga, which also launched a website and claims to have over a million readers per week (Ilanga, 2011).⁵⁴

In comparison, no Sesotho or other African language newspapers exist. The implication of this is that isiZulu speakers are much more exposed to L1 reading than any other African language spoken in South Africa. It can be assumed that they have a higher literacy level because of this and it would therefore be very interesting to gather and compare data for their static text and subtitle reading for L1 isiZulu as well as for L2 English. When compared to the findings for Sesotho and English reading in the current study, this will also offer interesting insights on the effect of continual L1 reading and a greater sense of a reading culture within the community on the general literacy skills of speakers of African languages.

- Furthermore, a bigger and more diversified sample needs to be drawn. The current study made use of students at a tertiary institution⁵⁵, but this does not represent the average South African citizen. In order to make generalizations about subtitling and what would be more efficient for the South African viewing public, one needs to measure the findings of a sample group that is truly representative in terms of language, race, culture, gender, age, education, literacy, disability, and economic and social demographics. However, the fact that the participants selected for the current study are as qualified as they are, having matriculated and enrolled for tertiary education, means that they represent the topmost section of the South African population, at least in terms of education and implied reading capabilities. Consequently, if the findings of the current study indicate that this specific group of participants have difficulty reading English L2 subtitles, chances are that the rest of

⁵⁴ No official circulation numbers could be found.

⁵⁵ Apart from the eye-tracking studies on language acquisition and vocabulary learning (Koolstra *et al.*, 1997; Koolstra & Beentjes, 1999; Koolstra *et al.*, 1999; and Van Lommel *et al.*, 2006) and d’Ydewalle and De Bruycker’s study on the eye movements of children and adults while reading television subtitles (2007), most eye-tracking studies made use of students at the respective universities where the research was conducted as participants. In this sense, the current study is therefore not all that different.

Chapter 6: Conclusions and recommendations

the population who do not share the same educational background will struggle even more. Nonetheless, a bigger, more representative sample is needed to gain insight into these struggles in order to address them and offer solutions.

- To obtain more representative results, one also needs to broaden the scope of material used. The experimental material needs to be changed to include different types of programming. The current study focused on subtitling as used for entertainment by using an animated short film with a narrative structure and not much visual complexity. Findings could differ considerably when showing participants other materials such as subtitled news broadcasts, documentaries, and educational or marketing material where there are different reasons and needs for reading and where there are different degrees of visual demands.
- Related to the first point of research to be addressed as mentioned above is the fact that Afrikaans L1 speakers' level of bilingualism is unique (cf. Coetzee-Van Rooy, 2010a). As was indicated by the findings for the Sesotho L1 speakers, further studies need to be conducted on language groups that do not share such a unique relationship of proficiency and use. Things to consider in such further research include the notion that English L1 speakers are typically more proficient in their L1 than, for instance, Afrikaans as their L2, and that due to educational background, speakers of the various African languages might be more skilled in their L2 than their home languages, in which case L1 subtitles might not prove to be a more effective alternative. However, as the current study found that the Sesotho L1 speakers generally understood the Sesotho static text better than the English text despite having read it at a much slower reading speed, a longer term intervention study would be able to offer insights on the impact of L1 subtitles on the improvement of literacy in the various language groups if people were to be exposed to it for longer periods of time.
- Lastly the possible relation between the reading of static text and subtitle reading needs to be explored more in-depth in order to make more accurate and conclusive generalizations about people's shared reading capabilities. These findings should then also be applied to the calculation of an ideal 'viewing speed' (Romero-Fresco, forthcoming, 2011) to ensure that people do not spend all their time reading the subtitles, but are given enough time to read and view the rest of the visuals on the screen.

6.6 CONCLUSION

Essentially subtitling and subtitling research in South Africa can still be regarded as being in its infancy. Only a few studies have been conducted on subtitling in South Africa in recent years. The most notable of these are the PANSALB⁵⁶ reports presented by Kruger, J.L., Verhoef and Kotze (2000), Kruger, J.L. and Kruger, H.C. (2001), and Kruger, J.L. (2003), which dealt with issues of multilingualism and subtitler training in South Africa. From this followed similar studies by Kruger, H.C. (2005), Kruger, J.L., Kruger, H. and Verhoef (2007), and Kruger, J.L. (2008). Since then, however, no studies of this nature and magnitude have been conducted.⁵⁷

Other countries that make use of subtitles have been doing so for much longer and much more intensively, catering for different user groups and making use of researched standards to ensure adequacy and efficiency. In this regard, South Africa still has a long way to go and needs to face some major challenges, the most telling of which is the presentation of different subtitles to different user groups. Our broadcasting network currently does not allow for open subtitling where people can choose whether they would like to read subtitles or not, much less the decision as to which language the subtitles should be in. This is an issue that needs to be addressed if equal access to media is to be granted to all language and user groups as per the Constitution. As Gambier (2006a:5) argues: “AVT [audiovisual translation] should not be seen as a constellation of problems but as a valuable asset addressing the need for multilingual and multicultural communication”.

One area where this asset has been most effectively applied worldwide is education (language acquisition and learning). These benefits are not limited to children or foreign people learning a language for the first time – subtitles have proven to increase the literacy and general reading ability of all people across the board (Ivarsson & Carrol, 1998; Kothari *et al.*, 2002; Danan,

⁵⁶ The Pan South African Language Board (PanSALB) “was established according to the Constitution of the Republic of South Africa (Act 106 of 1996) in order to (a) promote, and create conditions for the development and use of official languages, the Khoi and San languages, and sign language; (b) promote and ensure respect for all languages commonly used by communities in South Africa, including German, Greek, Gujarati, Hindi, Portuguese, Tamil, Telegu, and Urdu and; Arabic, Hebrew, Sanskrit, and other languages used for religious purposes in South Africa.” (PanSALB, s.a).

⁵⁷ Research on subtitling in South Africa include postgraduate studies on the possibilities that subtitles offer the public broadcaster (SABC) in terms of language equity and language rights (Olivier, 2003), subtitler training (Kruger, H.C., 2004) and subtitling practices (Msimang, 2006).

Chapter 6: Conclusions and recommendations

2004; Kothari *et al.*, 2004; Caimi, 2006; Gambier, 2006a; Chai & Erlam, 2008; Kothari, 2008; Perego, 2008; Ayonghe, 2009), and the more people read subtitles, the more these abilities are honed. The importance of this for subtitling in South Africa is to ensure that subtitles are as efficient as possible so that it can indeed be a tool for learning and development. Subtitles should be an aid in this regard, and not an obstruction.

The current study showed that for one particular group of viewers in the Afrikaans component of the study English L2 subtitles were not as efficient as L1 subtitles would have been. Some Afrikaans L1-speaking participants, those belonging to one of the test groups, spent more time reading the English L2 subtitles than did the English L1-speaking participants in the control group, meaning that the L2 subtitles were an obstruction hindering the processing of the text and information conveyed. In the Sesotho component of the study it was not only the L2 subtitles that were hindering the processing of the text and information conveyed – participants were consistently struggling to read the subtitles in their mother-tongue, Sesotho. Furthermore, unlike the findings for the Afrikaans L1 speakers, this was not an isolated finding for one group of viewers only – evidence of difficulty processing both Sesotho L1 and English L2 subtitles were found for all Sesotho L1-speaking participants throughout the entire film. In general, in both the Afrikaans and Sesotho components of the study, participants in both test and control groups spent more time in the subtitled area than one would have liked, regardless of whether the subtitles were English, Afrikaans or Sesotho, L1 or L2, meaning that the subtitles in general might not have been as efficient as one would have hoped for these groups.

Furthermore, contrary to what was mentioned before, the extent to which some participants claimed to be more exposed to subtitle reading did not coincide with easier reading and processing of the subtitles. The findings of the current study therefore cannot necessarily be applied to the broader population. Despite this, the findings of the current study do indicate a significant difference in L1 and L2 subtitle reading. If the difference is significant for two languages that share a unique and close relationship in terms of its use by the speakers thereof (as was found for Afrikaans and English, Chapter 4), the difference will be even greater for other languages that do not (as was found for Sesotho and English, Chapter 5), meaning that the significance and implications for the creation of subtitles in South Africa would be much greater.

Chapter 6: Conclusions and recommendations

There is still a lot to do and learn in order to make South African subtitles as optimally efficient as possible and to grant people from all walks of life equal access to media programming, but the fact that there are subtitles (although limited in more way than one) is already a step in the right direction. The recommendations and limitations of the current study will be addressed in future research in order to aid the production and presentation of subtitles in South Africa.

BIBLIOGRAPHY

ANON. 2011. Feature: Zulu newspapers thrive in S Africa.

<http://www.taipeitimes.com/News/world/archives/2011/04/06/2003500062> Date of access: 27 September 2011.

ASSINK, E., BOS, A.A. & KATTENBERG, G. 1996. Reading ability and the use of context in orthographic information processing. *The Journal of Genetic Psychology*, 157(4):381-396.

AYONGHE, L.S. 2009. Subtitling as an aid in academic literacy programmes: the University of Buea. Vanderbijlpark: NWU (Thesis – D.Phil.)

BAKER, R.G., LAMBOURNE, A.D. & ROWSTON, G. 1984. Handbook for television subtitlers. London: Independent Broadcasting Authority.

BBC. 1998. BBC subtitling guide. London: BBC.

BERNHARDT, E.B. & KAMIL, M.L. 1995. Interpreting relationships between L1 and L2 reading: Consolidating the Linguistic Threshold and the Linguistic Interdependence hypotheses. *Applied Linguistics*, 16(1):15-34.

BLOCH, G. 2009. A blueprint for learning. *Sunday Times*, 23 August.

<http://www.timeslive.co.za/sundaytimes/2009/08/23/a-blueprint-for-learning> Date of access: 10 September 2011.

BOGUCKI, L. 2004. The Constraint of Relevance in Subtitling. *The Journal of Specialised Translation*, 1:69-85. http://www.jostrans.org/issue01/art_bogucki_en.php

BRASEL, S.A. & GIPS, J. 2008. Points of view: where do we look when we watch TV? *Perception*, 37:1890-1894.

BRISBOIS, J.E. 1995. Connections between first- and second-language reading. *Journal of Reading Behaviour*, 27(4):565-586.

CAIMI, A. 2006. Audiovisual translation and language learning: the promotion of intralingual subtitles. *The Journal of Specialised Translation*, 6:85-98.

CARVER, R.P. 1990. *Reading Rate: A review of research and theory*. New York: Academic Press.

CARVER, R.P. 1992. Reading rate: theory, research and practical implications. *Journal of Reading*, 36(2): 84-95.

CHAI, J. & ERLAM, R. 2008. The effect and the influence of the use of video and captions on second language learning. *New Zealand Studies in Applied Linguistics*, 14(2):25-44.

COETZEE-VAN ROOY, A.S. 2010a. The importance of being multilingual. (Inaugural lecture delivered Quest Conference Centre of the Vaal Triangle Campus of the North-West University on 3 September 2010.) Vanderbijlpark. 42p. (Unpublished.)

COETZEE-VAN ROOY, A.S. 2010b. Higher education and making the most of multilingualism in the outer circle. (*In International Association for World Englishes. World Englishes today – a critical reevaluation of the theory, methodology, and pedagogy in global contexts: Papers read at the Sixteenth Annual Conference of IAWE held in Vancouver on 25 to 27 July 2010. Unpublished.*)

COETZEE-VAN ROOY, A.S. & VERHOEF, M.M. 2000. Perception of English proficiency: views from Southern Sesotho speakers. *South African Journal of Linguistics*, (Suppl.), 38:163-185.

COHEN, J. 1969. *Statistical power analysis for the behavioural sciences*. New York: Academic Press.

COHEN, J. 1977. *Statistical power analysis for the behavioural sciences*. Revised edition. New York: Academic Press.

CRUNDALL, D.E. & UNDERWOOD, G. 1998. Effects of experience and processing demands on visual information acquisition in drivers. *Ergonomics*, 41(4):448-458.

http://www.psychology.nottingham.ac.uk/staff/gju/Underwood_Papers/Ergonomics.1998.pdf

Date of access: 15 June 2010.

DANAN, M. 2004. Captioning and subtitling: undervalued language learning strategies. *Meta: Translators' Journal*, 49(1):67-77.

DE BRUYCKER, W. & d'YDEWALLE, G. 2003. Reading native and foreign language television subtitles in children and adults. (In Hyönä, J., Radach, R. & Deubel, H., eds. *The mind's eye: cognitive and applied aspects of eye movement research*. Oxford: Elsevier. p.671–684.)

DEHAENE, S. 2009. *Reading in the brain: the new science of how we read*. New York: Viking Penguin.

DE LINDE, Z. & KAY, N. 1999. *The semiotics of subtitling*. Manchester: St. Jerome.

DEPARTMENT OF EDUCATION. 2003. *Systemic Evaluation: Foundation Phase, Mainstream*. Pretoria: Department of Education.

DEPREZ, K. & DU PLESSIS, T. 2000. *Multilingualism and government*. Pretoria: Van Schaik.

DÍAZ CINTAS, J. & REMAEL, A. 2007. *Translation practices explained – audiovisual translation: subtitling*. Manchester: St. Jerome.

d'YDEWALLE, G. & DE BRUYCKER, W. 2007. Eye movements of children and adults while reading television subtitles. *European Psychologist*, 12(3):196-205.

d'YDEWALLE, G. & GIELEN, I. 1992. Attention allocation with overlapping sound, image, and text. (In Rayner, K., ed. *Eye movements and visual cognition: scene perception and reading*. New York: Springer-Verlag, p.414-427.)

- d'YDEWALLE, G., PRAET, C., VERFAILLE, K. & VAN RENSBURGEN, J. 1991. Watching subtitled television: automatic reading behaviour. *Communication research*, 18(5):650-666, Oct.
- FEHD, H.M. & SEIFFERT, A.E. 2008. Eye movements during multiple object tracking: where do participants look? *Cognition*, 108:201–209.
- GALE, A.G. 2003. Commentary on Section 5: eye movements in communication and media applications. (In Hyönä, J., Radach, R. & Deubel, H., eds. *The mind's eye: cognitive and applied aspects of eye movement research*. Oxford: Elsevier. p.729-732.)
- GAMBIER, Y. 2006a. Multimodality and audiovisual translation. (In Marie Curie Euroconferences. Paper read at the MuTra Multidimensional Translation Proceedings held in Copenhagen on 1 to 5 May 2006. Copenhagen. p. 1-8.)
http://www.euroconferences.info/proceedings/2006_Proceedings/2006_proceedings.htm
 Date of access: 10 June 2009.
- GAMBIER, Y. 2006b. Subtitling. (In Brown, K., ed. *Encyclopedia of language and linguistics*. 2nd ed. Boston: Elsevier. p.258-263.)
- GIBSON, E. 1998. Linguistic complexity: locality of syntactic dependencies. *Cognition*, 68:1–76.
- GOTTLIEB, H. 1992. Subtitling. a new university discipline. (In Dollerup, C. & Loddegaard, A., eds. *Teaching translation and interpreting: Training, talent and experience*. Amsterdam: John Benjamins. p.161-170.)
- GOTTLIEB, H. 1994. Subtitling: people translating people. (In Dollerup, C. & Lindegaard, A., eds. *Teaching Translation and Interpretation 2: Insights, Aims, Visions*. Selected papers from the Second Language International Conference, Elsinore, 4-6 June 1993. Amsterdam: John Benjamins. p.261-274.)
- GUILLORY, H.G. 1998. The effects of keyword captions to authentic French video on learner comprehension. *CALICO Journal*, 15(1-3):89-108.

HAJMOHAMMADI, A. 2004. The Viewer as the focus of subtitling: towards a viewer-oriented approach. *Translation Journal*, 8(4). October. <http://accurapid.com/journal/30subtitling.htm>
Date of access: 20 September 2010.

HOLMQVIST, K., NYSTROM, M., ANDERSSON, R., JARODZKA, H. & VAN DE WEIJER, J. (forthcoming). Eye tracking data and dependent variables.

HOLSANOVA, J. 2007. Cognition, multimodal interaction and new media. (*In Rønnow-Rasmussen, T., Petersson, B., Josefsson, J. & Egonsson, D., eds. Hommage à Wlodek. Philosophical papers dedicated to Wlodek Rabinowicz. p.1-14.*)
www.fil.lu.se/HommageaWlodek/site/papper/HolsanovaJana.pdf Date of access: 12 January 2010.

HUMAN DEVELOPMENT REPORTS. 2009. Human Development Report 2009.
<http://hdrstats.undp.org/en/indicators/99.html> Date of access: 11 August 2011.

ILANGA. 2011. Ilanga history. <http://www.ilanganews.co.za/history.html> Date of access: 27 September 2011.

IMS (INDEPENDENT MEDIA SUPPORT). 2000. The IMS style guide. London: IMS.

IMS (INDEPENDENT MEDIA SUPPORT). 2005. The IMS general translation style guide. London: IMS.

ITC. 1999. ITC Guidance on Standards for Subtitling. Southampton: Southampton University Press.
http://www.ofcom.org.uk/static/archive/itc/uploads/ITC_Guidance_on_Standards_for_Subtitling.doc Date of access: 20 Aug. 2008.

IVARSSON, J. & CARROLL, M. 1998. Subtitling. Simrishamn: TransEdit.

JANSEN, J.D. 2009. Knowledge in the blood: confronting race and the apartheid past. Stanford: Stanford University Press.

JENKINS, J. 2003. *World Englishes: a resource book for students*. London: Routledge.

JUST, M.A. & CARPENTER, P.A. 1980. A Theory of reading: from eye fixations to comprehension. *Psychological Review*, 87(4):329-354, July.

KACHRU, B.B. 1992. Teaching World Englishes. (*In Kachru, B.B., ed. The other tongue. English across cultures. 2nd ed. Urbana, IL: University of Illinois Press. p.355-365*)

KAMWANGAMALU, N.K. 2007. One language, multi-layered identities: English in a society in transition, South Africa. *World Englishes*, 26(3):263–275.

KARAMITROGLOU, F. 1998. A proposed set of subtitling standards in Europe. *Translation Journal*, 2(2), April. <http://www accurapid.com/journal/04stndrd.htm> Date of access: 20 Feb. 2008.

KOLLMORGEN, S. & HOLMQVIST, K. 2007. Automatically detecting reading in eye tracking data. Abstract of PhD thesis completed at Lund University, Department of Cognitive Studies. www.lu.se/LUCS/144/LUCS.144.pdf Date of access: 16 June 2010.

KOOLSTRA, C. & BEENTJES, J.W.J. 1999. Children's vocabulary acquisition in a foreign language through watching subtitled television programs at home. *Educational Technology Research and Development*, 47(1):51-60.

KOOLSTRA, C., PETERS, A.L. & SPINHOF, H.A. 2002. The pros and cons of dubbing and subtitling. *European Journal of Communication*, 17(3):325-354.

KOOLSTRA, C.M., VAN DER VOORT, T.H.A. & d'YDEWALLE, G. 1999. Lengthening the presentation time of subtitles on television: effects on children's reading time and recognition. *Communications*, 24(4):407-422.

KOOLSTRA, C.M., VAN DER VOORT, T.H.A. & VAN DER KAMP, L.J.T.H. 1997. Television's impact on children's decoding skills: a 3-year panel study. *Reading Research Quarterly*, 32(2):128-152, April/May/June.

KOTHARI, B. 2008. Let a billion readers bloom: same language subtitling (SLS) on television for mass literacy. *International Review of Education*, 54:773-780.

KOTHARI, B., PANDAY, A. & CHUDGAR, A. 2004. Reading out of the “Idiot Box”: same-language subtitling on television in India. *Information Technologies and International Development*, 2(1):23-44, Fall.

KOTHARI, B., TAKEDA, J., JOSHI, A. & PANDEY, A. 2002. Same language subtitles: a butterfly for literacy? *International Journal of Lifelong Education*, 21(1):55-66, January-February.

KRUGER, H.C. 2004. Parameters for the tertiary training of subtitlers in South Africa: integrating theory and practice. Vanderbijlpark: NWU. (Thesis – D.Phil.)

KRUGER, H.C. 2005. Towards a curriculum for the training of subtitlers in South Africa. *Southern African Linguistics & Applied Language Studies*, 23(4):431-444.

KRUGER, J.L. 2003. Training subtitlers in South Africa. Unpublished report: PanSALB.

KRUGER, J.L. 2008. Subtitler training as part of a general training programme in the language professions. (In Díaz Cintas, J., ed. *The didactics of audiovisual translation*. Amsterdam: John Benjamins. p71-87.)

KRUGER, J.L. & KRUGER, H.C. 2001. Subtitling in South Africa: summary report. PANSALB Occasional Papers 4. Pretoria: PanSALB.

KRUGER, J.L., KRUGER, H. & VERHOEF, M.M. 2007. Subtitling and the promotion of multilingualism: the case of marginalised languages in South Africa. (In Remael, A. & Neves, J. eds. *Linguistica Antverpiensia – a tool for social integration? Audiovisual translation from different angles*. p.35-49.)

KRUGER, J.L., VERHOEF, M.M. & KOTZE, H. 2000. Subtitling in South Africa. Unpublished report: PanSALB.

LE CORDEUR, M. 2010. Hemisferiese integrasie en die rolprent Fiela se Kind as onderrigstrategie om lees te bevorder. *Tydskrif vir Geesteswetenskappe*, 50(3):356-362, September.

LIVERSEDGE, S.P., RAYNER, K., WHITE, S.J., VERGILINO-PEREZ, D., FINDLAY, J.M. & KENTRIDGE, R.W. 2004. Eye movements when reading disappearing text: is there a gap effect in reading? *Vision Research*, 44:1013-1024.

MACDONALD, C.A. 2002. Are children still swimming up the waterfall? A look at literacy development in the new curriculum. *Language Matters*, 33: 111-141.

MATJILA, D.S. & PRETORIUS, E.J. 2004. Bilingual and biliterate? An exploratory study of grade 8 reading skills in Setswana and English. *Per Linguam*, 20(1):1-21.

McCONKIE, G.W. & YANG, S. 2003. How cognition affects eye movements during reading. (In Hyönä, J., Radach, R. & Deubel, H., eds. *The mind's eye: cognitive and applied aspects of eye movement research*. Oxford: Elsevier. p.413-427.)

MORRIS, R.K. & WILLIAMS, R.S. 2003. Bridging the gap between old and new: eye movements and vocabulary acquisition in reading. (In Hyönä, J., Radach, R. & Deubel, H., eds. *The mind's eye: cognitive and applied aspects of eye movement research*. Oxford: Elsevier. p.235-252.)

MOTSHEKGA, A. 2010. Matric pass rate drops. *News24.com*: 7 January.
<http://www.news24.com/SouthAfrica/News/Matric-pass-rate-drops-20100107> Date of access: 10 November 2010.

MSIMANG, V.B. 2006. Subtitling practices in South Africa: a case study of the soap opera *Generations*. Johannesburg: University of Witwatersrand. (Thesis – MA)

NEL, C., DREYER, C. & KLOPPER, M. 2004. An analysis of the reading profiles of first-year students at Potchefstroom University: a cross-sectional study and a case study. *South African Journal of Education*, 24(1): 95-103.

NUTHMANN, A. & ENGBERT, R. 2009. Mindless reading revisited: an analysis based on the SWIFT model of eye-movement control. *Vision Research*, 49:322-336.

NWU (NORTH-WEST UNIVERSITY). 2010a. Institutional Plan 2011-2013: draft for senior management 15 September 2010. Potchefstroom: North-West University.

NWU (NORTH-WEST UNIVERSITY). 2010b. Management report on student enrolment count: Vaal Triangle Campus. Unpublished report.

NWU (NORTH-WEST UNIVERSITY). 2010c. Management report on the reading ability of students at the Potchefstroom campus of the North-West University. Unpublished report.

OLIVIER, J.A.K.O. 2003. Die moontlikhede wat onderskrifte die SABC-TV bied in die erkenning en beskerming van taalregte. Vanderbijlpark: North West University. (Thesis – MA)

PANSALB. 2006. Pan South African Language Board: Annual report 2005/2006. Pretoria: Pansalb. [http://www.pansalb.org.za/2005-2006 Annual Report.pdf](http://www.pansalb.org.za/2005-2006%20Annual%20Report.pdf) Date of access: 1 March 2010.

PANSALB. s.a. PANSALB history: historical background. <http://www.pansalb.org.za/pansalbhistry.html> Date of access: 10 November 2010.

PAVAKANUN, U. 1992. Incidental acquisition of foreign language subtitled television programs as a function of similarity with native language and as a function of presentation mode. Leuven: University of Leuven. (Thesis – Doctoral; Unpublished)

PEREGO, E. 2008. What would we read best? Hypotheses and suggestions for the location of line breaks in film subtitles. *The Sign Language Translator and Interpreter*, 2(1):35-63.

POLLATSEK, A. & RAYNER, K. 2006. Eye-Movement Control in Reading. (In Traxler, M.J. & Gernsbacher, M.A., eds. *Handbook of Psycholinguistics*, 2nd ed. San Diego: Elsevier. p.613-657.)

- POLLATSEK, A., REICHLER, E.D. & RAYNER, K. 2003. Modeling eye movements in reading: extensions of the E-Z reader model. (*In* Hyönä, J., Radach, R. & Deubel, H., eds. *The mind's eye: cognitive and applied aspects of eye movement research*. Oxford: Elsevier. p.361-390.)
- POSEL, D. 2011. Adult literacy rates in South Africa: a comparison of different measures. *Language Matters*, 42(1):39-49.
- PRAET, C., VERFAILLIE, K., DE GRAEF, P., VAN RENSBURGEN, J. & d'YDEWALLE, G. 1990. A one line text is not half a two line text. (*In* Groner, R., d'Ydewalle, G. & Parham, R., eds. *From Eye to Mind: Information Acquisition in Perception, Search and Reading*. Amsterdam: Elsevier. p.205-213.)
- PRETORIUS, E.J. 2000. "What they can't read will hurt them": reading and academic achievement. *INNOVATION*, (21):33-41, Dec.
- PRETORIUS, E.J. 2010. Issues of complexity in reading: putting Occam's razor aside for now. *Southern Africa Linguistics and Applied Language Studies*, 28(4): 339-356.
- PRETORIUS, E.J. & CURRIN, S. 2010. Do the rich get richer and the poor poorer? The effects of an intervention programme on reading in the home and school language in a high poverty multilingual context. *International Journal of Educational Development*, 30:67-76.
- PRETORIUS, E.J. & MACHET, M.P. 2004. The socio-educational context of literacy accomplishment in disadvantaged schools: lessons for reading in the early primary school years. *Journal for Language Teaching*, 38(1):45-62.
- PRETORIUS, E.J. & MAMPURU, D.M. 2007. Playing football without a ball: language, reading and academic performance in a high-poverty school. *Journal of Research in Reading*, 30(1):33-58.
- PRETORIUS, E.J. & RIBBENS, I.R. 2005. Reading in a disadvantaged high school: issues of accomplishment, assessment and accountability. *South African Journal of Education*, 25(3):139-147.

RAYNER, K. & FISCHER, M.H. 1996. Mindless reading revisited: eye movements during reading and scanning are different. *Perception & Psychophysics*, 58(5):734-747.

RAYNER, K., SMITH, T.J., MALCOLM, G.L. & HENDERSON, J.M. 2009. Eye movements and visual encoding during scene perception. *Psychological Science*, 20(1):6-10.

RICHARDSON, D.C., DALE, R. & SPIVEY, M.J. 2007. Eye movements in language and cognition: a brief introduction. (In Gonzalez-Marquez, M., Mittelberg, I., Coulson, S. & Spivey, M.J., eds. *Methods in cognitive linguistics*. Amsterdam: John Benjamins. p.323–344.)

ROMERO-FRESCO, P., ed. (forthcoming: 2011) *The reception of subtitles for the deaf and hard of hearing in Europe*. Berlin: Peter Lang.

SCHMIDT-WEIGAND, F. 2009. The influence of visual and temporal dynamics on split attention: Evidences from eye tracking. (In Zheng, R.Z., ed. *Cognitive effects of multimedia learning*. New York: Information Science Reference. p.89-107.)

SERENO, S.C. & RAYNER, K. 2003. Measuring word recognition in reading: eye movements and event-related potentials. *TRENDS in Cognitive Sciences*, 7(11):489-493, November.

SMI (SENSOMOTORIC INSTRUMENTS). 2009a. iView X™ system manual: version 2.2. Teltow: SMI.

SMI (SENSOMOTORIC INSTRUMENTS). 2009b. BaGaze™ manual: version 2.3. Teltow: SMI.

SMI (SENSOMOTORIC INSTRUMENTS). 2009c. Experiment Center™ manual: version 2.3. Teltow: SMI.

SOKOLI, S. 2006. Learning via subtitling (LvS): a tool for the creation of foreign language learning activities based on film subtitling. (In Marie Curie Euroconferences. Paper read at the MuTra Multidimensional Translation Proceedings held in Copenhagen on 1 to 5 May 2006. Copenhagen. p. 1-8.) http://www.euroconferences.info/proceedings/2006_Proceedings/2006_Sokoli_Stravoula.pdf Date of access: 16 June 2010.

SOUTH AFRICA. 1996. The Constitution of the Republic of South Africa, Act 108 of 1996. Pretoria: Government Printer.

SOUTHAFRICA.INFO. 2011. The press in South Africa.

<http://www.southafrica.info/about/media/news.htm> Date of access: 27 September 2011.

STAR, M.S. & RAYNER, K. 2001. Eye movements during reading: some current controversies. *TRENDS in Cognitive Sciences*, 5(4):156-163, April.

STATISTICS SOUTH AFRICA. 2004. Census 2001: Primary tables South Africa: Census '96 and 2001 compared / Statistics South Africa. Pretoria: Statistics South Africa.

<http://www.statssa.gov.za/census01/html/RSAPrimary.pdf> Date of access: 1 Feb. 2010.

STEINBERG, J. 2004. A linking hypothesis: connecting eye movements and linguistic processing. Lund: Lund University. (Thesis – Masters) 21 p.

<http://www.humlab.lu.se/education/master-students/> Date of access: 20 July 2010.

TOSI, V., MECACCI, L. & PASQUALI, E. 1997. Scanning eye movements made when viewing film: preliminary observations. *International Journal of Neuroscience*, 92(1-2):47–52.

TRADING ECONOMICS. 2011. Literacy rate; adult total (% of people ages 15 and above) in South Africa. <http://www.tradingeconomics.com/south-africa/literacy-rate-adult-total-percent-of-people-ages-15-and-above-wb-data.html> Date of access: 11 August 2011

TRAXLER, M.K., MORRIS, R.K. & SEELY, R.E. 2002. Processing subject and object relative clauses: evidence from eye movements. *Journal of Memory and Language*, 47:69–90.

UNDERWOOD, G., BINNS, A. & WALKER, S. 2000. Attentional demands on the processing of neighbouring words. (In Kennedy, A., Radach, R., Heller, D. & Pynte, J., eds. *Reading as a Perceptual Process*. Oxford: Elsevier. p.247-268.)

UNICEF. 2010. South Africa: Statistics.

http://www.unicef.org/infobycountry/southafrica_statistics.html Date of access: 11 August 2011.

- VAN LOMMEL, S., LAENEN, A. & d'YDEWALLE, G. 2006. Foreign-grammar acquisition while watching subtitled television programming. *British Journal of Educational Psychology*, 76:243–258.
- VEIGA, M.J.A. 2006. Subtitling reading practices. (In Duarte, J.F., Rosa, A.A. & Seruya, T., eds. *Translation Studies at the interface of Disciplines*. Amsterdam: John Benjamins. p.161-168.)
- VITU, F., O'REGAN, J.K., INHOFF, A.W. & TOPOLSKI, R. 1995. Mindless reading: eye movement characteristics are similar in scanning letter strings and reading texts. *Perception and Psychophysics*, 57(3):352-364.
- VONK, W. & COZIEN, R. 2003. On the treatment of saccades and regressions in eye movement measures of reading time. (In Hyönä, J., Radach, R. & Deubel, H., eds. *The mind's eye: cognitive and applied aspects of eye movement research*. Oxford: Elsevier. p.291-311.)
- WAGNER, R.K., PIASTA, S.B. & TORGESEN, J.K. 2006. Learning to read. (In Traxler, M.J. & Gernsbacher, M.A., eds. *Handbook of Psycholinguistics*, 2nd ed. San Diego: Elsevier. p.1111-1142.)
- WOLHUTER, CC. 2011. Post-1994 educational developments. (In Booyse, J.J., Le Roux, C.S., Seroto, J. & Wolhuter, CC. eds. *A history of schooling in South Africa*. Pretoria: Van Schaik. p.269-283.)

FILMOGRAPHY

CELLIER, D., LIMOUZIN, F. & RÉAL, A., *directors*. 2006. Tong. Vichy: Cavilam. [DVD].

JULLIEN, P. & LEMOULAND, J.P., *directors*. 2000. Tadeus. Vichy: Cavilam. [DVD].

Both short films were taken from the following educational DVD:

DCCF (DIRECTION DE LA COOPERATION CULTURELLE ET DU FRANÇAIS). 2008. Génération Animée – 10 films d’animation avec livret pédagogique (DVD 2). Produced and released by Cavilam, l’Agence du court métrage, and the Ministry of Foreign and European Affairs (France). Vichy: Cavilam. [DVD].

APPENDIX A

Afrikaans text for reading and comprehension

SUDOKU!

"Sudoku," ja ek is seker die woord is al netso 'n bekende woord, amper soos die handelsmerke "Diesel, Quiksilver, Roxy, Red, BMW en Volvo." Sudoku is die nuwe vorm van verslawing, maar verslawing in die positiewe vorm van die woord. Verslawing amper soos in die verlede met "Rubik se kubus." Van julle wat nie weet nie, dit was 'n vierkantige blok met verskillende kleure, wat geskommel kan word en weer "reggesit" kan word. Ook natuurlik 'n baie goeie breinboelie! Sudoku is 'n syferspel wat die wêreld aan die kopkrap het. Vol afwagting wag jy elke dag vir die koerant. Nee, nie noodwendig vir die nuus of hooftrekke nie, nee vir jou nuwe uitdaging, Sudoku! Dit is 'n klein vierkant met hier en daar nommers en wit blokkies. Dit is 'n legkaart, op die oog af maklik, maar moenie mislei word nie, dit kan 'n taamlik frustrerend-moeilike legkaart wees! Dit verg geen algemene, taal- of wiskunde kennis nie. Net logika, maar beproef jou geduld, geheue, vasberadenheid, vaardigheid en uithouvermoë. Wanneer jy egter die raaisel oplos, weet jy dit was die moeite werd! Sudoku is 'n Japannese woord. "Su" beteken nommer en "doku" beteken enkele plek op 'n raaiselbord. Met ander woorde dit beteken "net enkelnommers." Jy hoef niks op te tel, af te trek of te vermenigvuldig nie. Intendeel, jy kan selfs die nommers met letters, simbole of kleure vervang. Elke legkaart bestaan uit nege rye by nege kolomme wat die raamwerk vorm. Die raamwerk is weer verdeel in nege streke wat bestaan uit drie rye by drie kolomme. Elke legkaart het sy eie nommers (leidrade) wat reeds in van die blokkies ingevul is. Elke ry moet die nommers 1 tot 9 bevat; elke kolom moet die nommers 1 tot 9 bevat en elke streek moet die nommers 1 tot 9 bevat, maar géén nommer mag meer as een keer in 'n ry, kolom of streek voorkom nie.

Daar is verskillende bespiegelings oor waar dit nou eintlik vandaan kom. 'n Ene prof. Hans Sudoku het glo reeds die eerste legkaart in 1741 ontwerp in 'n poging om sy etepartytjies op te vrolik. Leonard Euler, 'n Switserse wiskundige, het in die agtiende eeu 'n ou raaiselspel, genaamd "Latynse vierkante", waarin getalle net een keer kruis en dwars gebruik kon word, verder ontwikkel. Dit was net die inspirasie wat mnr. Howard Garns, 'n Amerikaanse argitek en vryskut-legkaartontwerper, nodig gehad het om sy Sudoku, of toe nog "Single number," in 1979 te ontwerp. Dit het dieselfde jaar die eerste keer in 'n legkaarttydskrif, "Dell pencil puzzels and word games," in New York, verskyn. Die Japannese het aan die legkaartverslawing gebyt, deur in die vroeë 1980's legkaarte in Japanse tydskrifte te begin invul. Maar dit was mnr. Wayne Gould, 'n 60 jarige legkaartliefhebber wat toevallig 'n voltooide Sudoku in 'n boek in 'n Japanse boekwinkel gevind het. Gould was so bang dat hy al die legkaarte in die boek sou voltooi, dat hy

'n rekenaarprogram geskryf het om self die legkaarte te ontwerp, sodat hy vir die res van sy lewe legkaarte kon invul. So het die verslawing toe wêreldwyd begin uitkring. Gould het gedurende 2004 die artikelredakteur van die "Times of London" oorreed om die legkaarte te publiseer. Vandag verskyn dit in 4 van die groot koerante wêreldwyd. Deesdae is daar verskillende boeke met verskillende moeilikheidsgrade in elke denkbare vorm te vinde. Boeke in die vorm van 'n glas of 'n koffiebeker is te koop. Mens kry Sudoku vir beginners, Sudoku vir juniors, en dan ook Sudoku vir die ouens wat hou van 'n ekstreme uitdaging. In baie tydskrifte sien mens deesdae allerlei aanbiedinge oor nuwe Sudoku-speletjies. Daar is nou selfs 'n elektroniese Sudoku-handspeletjie beskikbaar, met minstens 100 000 uitdagende raaisels om jou breinkrag te beproef. 'n Nuwe Sudoku-bordspel is ook nou beskikbaar. Nou hoef mens nie eers meer te sorg vir 'n potlood of uitveër nie. Die bordspel het sy eie nommerstukke wat Sudoku maklik maak.

Weekliks word daar in die VSA sowat 400 000 kopieë van Sudoku-boeke verkoop. Die enigste boek wat die syfers in September 2005 kon klop, was JK Rowling se "Harry Potter and the half-blood prince" en Kevin Trudeau se "Natural cures they don't know about." Geen legkaart het tot nog toe so vinnig posgevat in koerante sedert die blokraaisel-manie van 1924 nie. Meer as die helfte van die voorste Amerikaanse koerante publiseer al Sudoku-legkaarte. Byna al die legkaarte word met die rekenaar opgestel. So kan mens die moeilikheidsgraad bepaal asook herhalings uitskakel. Herhaling is juis nie 'n probleem nie. Volgens statistiek is die aantal moontlikhede om 'n 9 by 9 Sudoku-legkaart in te vul, geskat op 6 670 903 752 021 072 936 960. Aan die begin van Augustus 2005 was geen Sudoku-boeke op die "USA Today" se top 150-lys nie. Drie weke later was daar ses. Indien 'n mens op die internet, met die hulp van die soekenjin, Google, na Sudoku soek, kry jy dit by 13,7 miljoen plekke. Dit is moeilik om uit te vind wat daartoe aanleiding gee dat mense verslaaf word. Vir party mense is dit 'n oorwinning oor jarelange "wiskunde-vernederings" op skool. So sê Me. Jooste van Johannesburg: "Vir my was dit 'n oorwinning oor syfers om 'n legkaart te voltooi. As ek syfers sien, slaan ek toe, maar dié syfers kan ek baasraak. Telkens troos ek myself dat dit baie stimulerend is en goeie oefening vir my brein." Selfs mense in hospitale vind dit baie stimulerend. So ook kan dit help om veroudering teë te werk aangesien dit breinoefening is. Met Sudoku is daar geen lang vervelike vakansies meer nie. Die elektroniese-handspeletjie maak selfs lang vakansieritte see toe korter! Die Sudoku junior is 'n baie goeie manier om klein kindertjies geduld en deursettingsvermoë te leer. Daar is gelukkig geen gevaar in Sudoku nie, mens kan wel tyd verloor of jou familie of vriende verwaarloos. Het jy al vandag jou Sudoku voltooi? Kry dadelik die koerant, of jou bordspel of jou elektroniese handspeletjie en begin!!!

APPENDIX B

Comprehension test for Afrikaans reading

Studentenr:

--	--	--	--	--	--	--	--	--	--

Begripsvrae: Afrikaans

Maak asseblief 'n kruisie (X) in die blokkie wat die gepaste antwoord voorstel.

Bv.

1. Vraag	<input checked="" type="checkbox"/> (a)	Moontlike antwoord.
	<input type="checkbox"/> (b)	Moontlike antwoord.

Sudoku!

1. Wat is positiewe verslawing?	(a)	Verslawing waarvan mens genees kan word.
	(b)	Sudoku.
	(c)	Dwelms.
	(d)	Drank.
2. Wat is 'n breinboelie?	(a)	lets wat 'n mens se brein seermaak.
	(b)	lets wat 'n mens se brein oefen.
	(c)	lets wat mens se kop seermaak.
	(d)	lets wat mens seermaak.
3. Watter stelling is onwaar?	(a)	Sudoku is taamlik frustrerend-moeilike legkaart.
	(b)	Sudoku is taamlik frustrerend-maklike legkaart.
	(c)	Sudoku is taamlik frustrerend-saai legkaart.
	(d)	(b) en (c)
4. Watter stelling is waar?	(a)	Geen nommer mag meer as twee keer in 'n ry, kolom of streek voorkom nie.
	(b)	Geen nommer mag meer as een keer in 'n ry, kolom of streek voorkom nie.
	(c)	Geen nommer mag meer as een keer in 'n ry of streek voorkom nie.
	(d)	Geen nommer mag meer as een keer in 'n kolom of streek voorkom nie.

5. Wie het die eerste voltooide Sudoku in 'n boek in 'n Japanese boekwinkel gevind?	(a)	Wayne Gould.
	(b)	Howard Garnes.
	(c)	Hans Sudoku.
	(d)	Wayne Gourd.
6. Wie het 'n rekenaarprogram geskryf om Sudoku-legkaarte te ontwerp?	(a)	Wayne Gould.
	(b)	Hans Sudoku.
	(c)	Leonard Euler.
	(d)	Howard Garnes.
7. Sudoku is _____ .	(a)	verslawend en stimulerend.
	(b)	stimulerend en goeie oefening.
	(c)	verslawend en vervelig.
	(d)	verslawend en tydrowend.
8. Sudoku leer klein kindertjies _____ .	(a)	tyd mors.
	(b)	deursettingsvermoë en geduld.
	(c)	verslawende gedrag.
	(d)	lees.
9. Alle Sudoku-legkaarte is ewe moeilik.	(a)	Ja, want dit word met die rekenaar opgestel.
	(b)	Nee, want dit word met die rekenaar opgestel.
	(c)	Nee, omdat dit met die rekenaar opgestel word, is daar verskillende moeilikheidsgrade.
	(d)	Ek weet nie.
10. Sudoku-legkaarte kan maklik herhaal word.	(a)	Nee, die rekenaar skakel herhalings uit.
	(b)	Volgens statistiek is dit amper onmoontlik om 'n legkaart te herhaal.
	(c)	Ek weet nie.
	(d)	verslawend en stimulerend.

TOTAAL	
---------------	--

APPENDIX C

Sesotho text for reading and comprehension

SUDOKU!

“Sudoku,” e, ke a dumela hore jwale lentswe lena le se le tsetjwa hantle jwaloka lentswe le tshwanang le “Diesel, Quiksilver, Roxy, Red, BMW le Volvo”. Sudoku ke sebopelo se setjha sa ho lemalla ntho, empa temallo ka kutlwisiso e ntle. Temallo e tshwanang le ya “Rubic’s cube” nakong e fetileng. Bakeng sa lona ba sa tsebeng, ke sebopelo se nang le dikgutlo tse nne se nang le mebala e fapaneng e ka hlokoahlwang e be e ya lokiswa hape. Ka ho utlwalang e boetse ke tsela e ntle ya ho phephetsa boko. Sudoku ke papadi ya dinomoro e makatsang lefatshe. O emela kuranta ka thlolohelo letsatsi le letsatsi. Che, e seng bakeng sa ditaba kapa dihlooho tsa tsona, empa bakeng sa phephetso e ntjha, Sudoku! Ke kgutlonne e nang le dinomoro le dibopelo tse kgutlonne tse tshweu mona le mane. Ke malepa, a bonolo ha o a habanya feela, empa o se ke wa thetswa, e ka ba malepa a fedisang pelo le a thata. Ha se hloke tsebo e batsi, tsebo ya puo kapa ya dipalo, se hloka ho beha mabaka ka tsela e utlwalang feela. Se leka mamello, mohopolo, boikemisetso, bokgoni le pelotelle. Empa ha o rarollotse malepa, o tla tseba hore e ne e se hwa lefeela. Sudoku ke lentswe la Sejapane. “Su” e bolela nomoro mme “doku” e bolela sebaka se le seng letlapeng la malepa. Ka mantswa a mang se bolela “dinomoro tse ikemetseng ka bonngwe”. Ha o a lokela ho kopanya, ho tlosa kapa ho atisa ntho leha e le efe. Ntle le moo, o ka ba wa emela dinomoro ka mantswa, ditshwantsho kapa mebala. Malepa ka nngwe a entswe ka mela e robong e yang tlase le e meng e tshekaletseng ho bopa moralo. Moralo o arotswe ka dibaka tse robong tse entsweng ka mela e meraro e theosang ka e meraro e tshekaletseng. Malepa ka nngwe a na le dinomoro tsa oona tse seng di tlatsitswe dikgutlonneng tse ding. Mola ka mong o tshekaletseng o na le dinomoro 1 ho ya ho 9, mme sebaka ka seng se fupere dinomoro 1 ho ya ho 9. Empa ha ho nomoro e lokelang ho hlaha ka makgetlo a fetang le le leng moleng ka mong o tshekaletseng, moleng ka mong o theosang kapa sebaka.

Ho na le maikutlo a fapaneng hore hantle- ntle Sudoku e tswa kae. Ho thwe mprofesara e mong, Hans Sudoku, o ne a se a ntse a radile malepa a pele ka 1741 e le boiteko ba ho natefisa meketjana ya hae ya dijo. Mongwakgolong wa leshome le metso e robedi, Leonard Euler, radipalo wa Moswetsereleane, o ile a ntlafatsa papadi ya malepa e bitswang “Latin squares”, eo ho yona dinomoro di neng di dumellwa ho sebediswa hanngwe feela ho ya tlase le ho tshekalla. Ke yona feela tshusumetso eo Mong. Howard Garns, setsebi sa meralo ya meaho, eo hape e neng e boetse e le setsebi se ikemetseng sa meralo ya malepa, a neng a e hloka ho qapa Sudoku sa hae, seo ka nako eo se neng se tsebahala feela ka “Single number,” ka 1979.

Sona selemong seo se ileng sa hlahella makasineng wa “Dell pencil puzzle and word games” New York ka lekgetlo la pele. Majapane a ile a hokellwa temallong ya malepa ka ho qala ho tlatsa malepa dimakasineng tsa Majapane maqalong a bo 1980. Empa ke Mong. Wayne Gould, mohlanyetsi was malepa ya dilemo di 60, eo ka tshohanyetso a ileng a fumana Sudoku se tlatsitsweng ka botlalo ka hara buka lebenkeleng Japan. Gould o ne a tshohile hore ho ka etsahala hore a tlatse malepa oohle a bukeng kahoo a sebedisa khompheutha ho qapa malepa ka boyena e le hore a ka ba le malepa ao a ka a tlatsang nakong yohle ya bophelo ba hae. Ka tsela e jwalo temallo ya aparela lefatshe lohle. Ka 2004 Gould o ile a kgodisa “Times ya London” ho phatlalatsa malepa. Kajeno e hlahella dikoranteng tse 4 tse kgolo ka ho fetisisa lefatsheng. Matsatsing ana ho na le dibuka tse fapaneng tse nang le tekanyo e fapaneng ya boima e ka fumanwang ka dibopeho tse fapaneng. Dibuka di bile di ka rekiswa ka dibopeho tsa galase kapa lebekere la kofi. Ho na le Sudoku bakeng sa ba qalang, Sudoku sa batjha, le Sudoku sa batho ba ratang phephetso e feteletseng. Dimakasineg tse ngata kajeno motho a ka fumana dimemo tsa mefuta e fapaneng tsa papadi e ntjha ya Sudoku. Ho boetse ho na le papadi ya eletronic ya letsoho ya Sudoku e fumanehang e nang le diphephetso tse bonyane 100 000 ho leka matla a motho a boko. Le papadi e ntjha ya letlapa ya Sudoku e a fumaneha. Ha ho hlokahale hore motho a be a tshwenyehe ka potloloto kapa raba ya ho phumola – papadi ya letlapa e na le sete ya yona ya dikarolwana tsa dinomoro tse etsang hore Sudoku se be bonolo.

Ho rekiswa dikgatiso tse ka bang 400 000 tsa dibuka tsa Sudoku beke ka nngwe Amerika. Buka feela e ileng ya fumana dipalo-palo tse hodimo ka Lwetse 2005 ke “Harry Potter and the half-blood prince” ya JK Rowling le “Natural cures they don’t know about” ya Kevin Trudeau. Ha ho malepa a ileng a ratwa hakana ha e sa le ho tloha ka malepa a cross-word puzzle ya 1924. Dikoranta tse fetang halofo tsa Amerika di se di phatlalatsa malepa a Sudoku. Hoo e batlang e le malepa oohle a boptjwa ka khompheutha. Sena se thusa ho lekanyetsa dikgato tsa boima le ho tlosa pheta-pheto. Empa pheta-pheto ha se bothata hakaalo. Ho latela dipalo-palo lenane la menyetla ya ho tlatsa malepa a 9 ka 9 a Sudoku a lekanyetswa ho 6 670 903 752 021 072 936 960. Maqalong a Phato 2005 ho ne ho se na Sudoku lenaneng la dibuka tse 150 tse hlahelletseng la “USA Today”. Dibeke tse tharo ka mora moo di ne di tsholetse. Haeba motho a sheba Sudoku interneteng ka browser, ya Google, o e fumana dibakeng tse dimilione tse 13,7. Ho thatha ho fumana lebaka le etsang hore batho ba be le temallo. Ho ba bang ke tlholo hodima dilemo tsa ho sotlwa ke dipalo sekolong. Mof. Jooste wa Lejweleputswa o re: “ho nna ho tlatsa malepa ke tlholo hodima dipalo. Ha ke bona dipalo ke ya hwama, empa dipalo tsena ke a di kgona.

Nako le nako ke fumana matshediso ho tseba hore ho a hlasimolla ebile ho hotle ho kwetlisa boko ba ka.” Le batho ba sepetlele ba e fumana e hlasimolla. E ka ba ya thusa ho hanela ho tsofala kaha ke boikwetliso ba boko. Ka Sudoku ha ho sa na matsatsi a phomolo a malelele le a tenang. Papadi ya electronic e tshwarwang ka letsoho e etsa maeto a malelele a ho ya lewatile a be makgutshwane. Sudoku ya bana e molemo bakeng sa ho ruta bana ba banyenyane mamello le pelo e telele. Ka lehlohonolo ha ho na kotsi ho Sudoku, le hoja motho a ka lahlehelwa ke motjha wa nako kapa a hlokomoloha lelapa le metswalle. Na o se o tlatsitse Sudoku sa hao kajeno? Nka pampiri, papadi ya hao ya letlapa kapa papadi e tshwarwang ka letsoho ya electronic hang-hang mme o qalelle!!!

APPENDIX D

Comprehension test for Sesotho reading

Nomoro ya moithuti:

--	--	--	--	--	--	--	--

Dipotso tsa Kutlwisiso: Sesotho

Ka kopo sebedisa letshwao (X) lebokoseng le emelang karabo e nepahetseng.

Mohlala

1. Potso	(c)	Karabo.
	(d)	Karabo.

Sudoku!

1. Temallo e ntle ke eng?	(a)	Temallo e alafhang.
	(b)	Sudoku.
	(c)	Dithethefatsi
	(d)	Tahi.
2. Papadi ya ho phephetsa boko ke eng?	(a)	Ntho e utlwisang boko bohloko.
	(b)	Ntho e kwetlisang boko.
	(c)	Ntho e utlwisang hlooho bohloko.
	(d)	Ntho e kotsi ho motho.
3. Ke polelo efe e fosahetseng?	(a)	Sudoku se fedisa pelo ebile se thatha.
	(b)	Sudoku se fedisa pelo ebile se bonolo.
	(c)	Sudoku se fedisa pelo ebile se a tena.
	(d)	(b) le (c)

4. Ke polelo efe e nepahetseng?	(a)	Ha ho nomoro e lokelang ho hlaha ho feta habedi, moleng o tshekaletseng, moleng o theosang kapa sebakeng se itseng.
	(b)	Ha ho nomoro e lokelang ho hlaha ho feta hang moleng o tshekaletseng, moleng o theosang kapa sebakeng se itseng.
	(c)	Ha ho nomoro e lokelang ho hlaha ho feta hanggwe moleng o tshekaletseng kapa sebakeng se itseng.
	(d)	Ha ho nomoro e lokelang ho hlaha ho feta hanggwe moleng o theosang kapa sebakeng se itseng.
5. Ke mang ea ileng a fumana Sudoku sa pele se tlatsitsweng lebenkeleng la dibuka Japane?	(a)	Wayne Gould.
	(b)	Howard Garnes.
	(c)	Hans Sudoku.
	(d)	Wayne Gourd.
6. Ke mang ya bopileng lenaneo la khomphuetha le qapang malepa a Sudoku?	(a)	Wayne Gould.
	(b)	Hans Sudoku.
	(c)	Leonard Euler.
	(d)	Howard Garnes.
7. Sudoku se _____ .	(a)	a lemalla le ho hlasimolla.
	(b)	a hlasimolla le ho kwetlisa.
	(c)	a lemalla le ho tena.
	(d)	a lemalla le ho ja nako.
8. Sudoku se ruta bana ba banyenyane _____ .	(a)	ho senya nako.
	(b)	ho mamella le ho ba pelotelle.
	(c)	boitshwaro ba ho lemalla dintho.
	(d)	ho bala.

9. Malepa oohle a Sudoku a ya lekana ka boima.	(a)	E, hobane a bopilwe oohle ka khomphuetha.
	(b)	Che, hobane a bopilwe oohle ka khomphuetha.
	(c)	Che, hobane a bopilwe oohle ka khomphuetha a na le dikgato tse fapaneng tsa boima.
	(d)	Ha ke tsebe.
10. Malepa a Sudoku a ka phethwa habobebe.	(a)	Che, khomphuetha e etsa hore ho se kgonehe ho phetha.
	(b)	Ho latela dipalo-palo ho batla ho lethatha ho phetha malepa.
	(c)	He ke tsebe.

KAKARETSO	
------------------	--

APPENDIX E

English text for reading and comprehension

ROCK, PAPER, SCISSORS

It takes a minute to learn, a lifetime to master. Rock, paper, scissors: everybody knows this game. The rules are simple, rules that people all over the world grasp as young children. Rock, paper, scissors or in short, RPS, is the world's most popular method of decision - making. But how do you play this game? After an agreed set of "primes," players throw one of three possibilities: Rock (closed fist), Paper (hand flat), or scissors (top two index fingers extended). Rock crushes scissors. Scissors cut paper. Paper covers rock. This game goes by many names, like Jenken, Jan Ken Pon, Roshambo, Shnik Shnak Shnuk, Ching Chong Chow, Farggling, Scissors Paper Stone and Scissors Rock Paper. Rock, paper, scissors has gained a cult following in much of the English-speaking world over the last few years. The World Rock Paper Scissors Society, based in Canada, says its history dates back to London in the mid-1800s and that its membership has grown from just five to 2300 since its website, www.worldrps.com, first appeared in 1995. RPS is played over the world. More people have played RPS than any other game in the world. Word of mouth generated by the site and by the world championships that the society has sponsored since 2002, has led to a spread of formal and impromptu tournaments. Now the society's directors, brothers Douglas and Graham Walker, have written "The Official Rock, Paper, Scissors Strategy Guide". Rock Paper Scissors: The Movie, a documentary about the 2003 world championships in Toronto, was released in 2005. Experienced players have some tips. "The key is to throw scissors early and often." Aaron Hoffman, a postgraduate mathematics student, suggested. Younger and aggressive (or American) players tend to favour the Rock crushing Scissors view. More liberal-minded players take the view that scissors are dulled by the Rock. The World RPS Society created a task force in 1987 with a hope of eventually resolving the issue but it has been locked in debate and we no longer hold much hope of quick resolution.

The symbolic meaning of paper covering a rock, dates back to ancient Chinese culture. When a petition was made to the Emperor, the petition was signified by a rock. Upon making a decision, the Emperor would have his servants place a sheaf of paper either over or under the rock. If the sheaf was placed under the rock it would signify acceptance of the petition. If the sheaf was placed on top of the rock, it signified denial of the petition. Over time the symbolic image of paper covering a rock became synonymous with defeat. According to English laws dating back as far as 1842, RPS matches may only be played to make a decision on something. However, often frivolous excuses are made up in order to play. Due to the ensuing public outrage, the law was later amended to include RPS games for "honour". Since the inception of the World RPS

Society the vast majority of games have indeed been for honour. The World RPS Society is the worldwide governing body of the sport of RPS. It provides overall direction, guidance and policy control with a goal of promoting the sport to a wider audience. It is supported by a standard operational branch, local, regional, national and international office structure with offices in most countries around the globe. Its World Headquarters is located in Toronto, Canada at Trinity Square Plaza. (Soon to be moving to Trinity Square Towers). It plans and executes tournaments, conferences, symposiums, retreats and get togethers all over the globe.

Many players bring differing local customs or regional differences that can even occur amongst local players (often erroneously referred to as European rules [2 prime shoot] or North American rules [3 prime shoot]). The best advice is always to ask your opponent how they shoot BEFORE you begin play (to avoid certain unscrupulous players from taking advantage of the confusion) otherwise you risk showing your opponent your first move. Should you determine that your "opening prime" differs from that of your opponent, it is always proper etiquette to offer to play the opening prime of whoever is considered to have "local turf". The locations for RPS tournaments are determined by drawing straws. Originally it was decided by RPS, however the fierce competition between the LOCs (Local Organising Committees) resulted in certain unnamed local clubs holding back their best competitors from the actual tournaments, in order to gain the advantage in competing for the allocation of the game locations and thereby secure the financially lucrative tourism benefits. This downgraded the level of play in the tournaments and generated more excitement for the allocation competitions than the RPS World Championships themselves. Thus, in a hotly debated meeting of the World RPS Steering Committee in 1985, the use of RPS was outlawed in the allocation proceedings. In a rare display by the retired veterans of the Steering Committee, this decision was determined by a boldly executed Scissor Sandwich over an Avalanche. According to "The Official Rock, Paper, Scissors Strategy Guide", from Random House, here are a few rules: Whether you are playing at school or at pro level, this is serious stuff. Honour is at stake!

Face your opponent and vertically prime by moving an outstretched fist at waist height up and down towards your shoulder. A call for prime is issued by one player. In a recognisable audible tone (RAT). The word "ready" is standard. If silence is critical, a recognisable visual signal (RVS) will do, i.e. a nod of the head with direct eye contact. As soon as one player has initiated the first prime, the other player must "catch" or "synch" the prime for an approach and delivery in unison. At the highest point of the final prime, the delivery of the throw is "in approach".

When the forearm is at a 90-degree angle to the upper body, release the hand as either a rock, paper or scissors. Wiggling fingers in a scissor like motion or making "snipping" sounds is considered bad form. Here is a summary of the most common abstract meanings of the throws: Rock - Power, Strength, Aggression, Nature; Paper – Passivity, Stealth, Wisdom (money sometimes as well), Literacy; Scissors – Deviousness, Ingenuity, Evil, Technology.

In terms of the psychological roles that the elements play in a game of RPS, it is usually agreed that R = Aggressive, P = Passive, S = Devious.

APPENDIX F

Comprehension test for English reading

Student nr:

--	--	--	--	--	--	--	--	--	--

Comprehension Questions: English

Please put a cross (X) in the block that represents the appropriate answer.

E.g.

1. Question	<input checked="" type="checkbox"/> (a)	Possible answer.
	<input type="checkbox"/> (b)	Possible answer.

Rock, paper and scissors

1. What is RPS primarily used for?	(a)	A game of entertainment.
	(b)	Decision-making.
	(c)	To better skills in arm movement.
	(d)	To practice quick thinking.
2. How do players “throw” scissors?	(a)	With a closed fist.
	(b)	With a flat hand.
	(c)	With top two index fingers extended.
	(d)	With scissor-like motion and snipping sounds.
3. What is the result when rock and paper are thrown?	(a)	Rock crushes paper.
	(b)	Paper covers rock.
	(c)	Rock tears paper.
	(d)	None of the above.
4. What is: “RPS the Movie” about?	(a)	A strategy guide on RPS.
	(b)	A documentary on RPS strategy.
	(c)	Formal and impromptu RPS tournaments.
	(d)	The 2003 RPS World championships.

5. What opinion do young American players favour?	(a)	To throw scissors early and often.
	(b)	The rock dulling scissors view.
	(c)	The rock crushing scissors view.
	(d)	The world RPS Society's view.
6. How did paper covering rock become synonymous with defeat?	(a)	If a Chinese petition to the emperor was returned on top of a rock, it meant defeat.
	(b)	If a Chinese petition to the emperor was returned under a rock, it meant denial.
	(c)	If a Chinese petition to the emperor was returned on top of a rock, it meant acceptance.
	(d)	If a Chinese petition to the emperor was returned under a rock, it meant resolution.
7. As there are different opening primes, whose do you usually use?	(a)	The opponent who has the closest prime.
	(b)	The most practical prime of the two.
	(c)	The prime of the person moving first.
	(d)	The prime of the person considered to be local.
8. Why is the allocation of the tournament location vitally important?	(a)	Home games have emotional advantages.
	(b)	Home games have lucrative tourism benefits.
	(c)	The best players want home game status.
	(d)	Drawing of straws for home games is prohibited.
9. How is a call for prime issued between players?	(a)	The word "ready" is stated in a recognisable audible tone.
	(b)	By a nod of the head with direct eye contact.
	(c)	By both (a) and (b).
	(d)	By either (a) or (b).
10. Which abstract meanings apply to paper?	(a)	Money, wisdom, literacy and passivity.
	(b)	Strength, nature, passivity.
	(c)	Stealth, deviousness, evil.
	(d)	Technology, literacy.

TOTAL	
--------------	--

APPENDIX G

Complete questionnaire and consent form

Student nr:

--	--	--	--	--	--	--	--	--	--

Information and consent

This questionnaire includes questions about your **language** history, experience, proficiency and use; questions on your exposure to and preference of **audiovisual means of communication**; as well as questions on your **subtitle reading** skills and proficiency, your opinion on the benefits of subtitles and your impression of the quality of South African subtitles.

The aim of this questionnaire is to reflect on the language exposure, reading and subtitling practices of literate South Africans. The information provided will be used for research and will be incorporated into a guideline on how subtitles should be adapted for South African viewers in order to be received and read more efficiently.

The information provided by you, the participant, will not influence your academic results in any way, nor bring you any harm. The data will be treated and reported anonymously in the current study as well as in any report or publication that follows from it. However, should you, the participant, wish to view your own data and results, you are free to do so. You are only free to view your own data, all other data will be treated as confidential.

When you agree to participate in this experiment by completing this questionnaire, you give permission to the researcher to:

- (a) View and analyse your personal information as provided in this questionnaire;
- (b) Record your reading of plain text and of subtitles by means of a non-invasive eye tracker; and
- (c) Report, anonymously, the data gathered from this questionnaire, as well as your eye-tracking data for plain text reading and your eye-tracking data for subtitle reading in the current study as well as in any report or publication that follows from it.

I, (please write out your full names and surname) _____

give permission to the researcher, Esté Hefer, and the research unit UPSET (Understanding and Processing Language in Complex Settings) of the North-West University, to report the data gathered from this questionnaire, my eye-tracking data for plain text reading and my eye-tracking data for subtitle reading anonymously in the current study as well as in any report or publication that follows from it.

Signature

Date

SECTION A: Biographical information

Please put a cross (X) or a tick (✓) in the block that represents the appropriate answer at the following questions, or write down an answer.

1 Gender

Female	1	Male	2
---------------	----------	-------------	----------

2 Age: Today, I am _____ years old.

3 Which of the following statements describe the high school where you matriculated (completed Grade 12) the best?

Urban high school in township	1
Urban high school – ex-Model C	2
Urban private high school	3
Rural high school in township	4
Rural high school – ex-Model C	5
Rural private high school	6
I was home schooled in an urban area	7
I was home schooled in a rural area	8

4 What qualification are you enrolled for?

5 What career do you plan to follow after completion of this qualification?

6 What is the highest educational level completed by your father?

I do not know my father	1
My father completed primary school (Grade 7 / former Standard 5)	2
My father completed secondary school (Grade 12 / former Standard 10)	3
My father completed a qualification/s at University / College	4

7 What is the highest educational level completed by your mother?

I do not know my mother	1
My mother completed primary school (Grade 7 / former Standard 5)	2
My mother completed secondary school (Grade 12 / former Standard 10)	3
My mother completed a qualification/s at University / College	4

8 Country of birth

(8a) Were you born in South Africa?

Yes	1
No	2

If “Yes”, please go to question 9.

If “No”, please answer the following questions (8bi, 8bii, 8biii, 8biv) as well.

(8bi) ***I was born in (town / city & country)***_____

(8bii) How old were you when you came to South Africa?

I was _____ years old when I came to South Africa.

(8biii) How long have you been living in South Africa to date? ***Today, I have been living in South Africa for _____ years.***

(8biv) Have you returned to your country of birth for longer than 6 months?

Yes	1
No	2

SECTION B: Language history, experience, proficiency, use

Please put a cross (X) or a tick (✓) in the block that represents the appropriate answer at the following questions, or write down an answer.

9 Please look at the following grid with languages. Please mark the ONE language you use at home most of the time.

Afrikaans	1	Shona	12
Dutch	2	Southern Sotho	13
English	3	Spanish	14
French	4	Swati	15
German	5	Tsonga / Shangaan	16
Hebrew	6	Tswana	17
Italian	7	Venda	18
Ndebele	8	Xhosa	19
Ndonga	9	Zulu	20
Northern Sotho	10	Other (specify below):	
Portuguese	11		

10 Please mark ALL the languages you know in the grid below.

Afrikaans	1	Shona	12
Dutch	2	Southern Sotho	13
English	3	Spanish	14
French	4	Swati	15
German	5	Tsonga / Shangaan	16
Hebrew	6	Tswana	17
Italian	7	Venda	18
Ndebele	8	Xhosa	19
Ndonga	9	Zulu	20
Northern Sotho	10	Other (specify below):	
Portuguese	11		

11 Please list all the languages you know in order of your proficiency / ability in them. In other words, my L1 is the language with which I express myself the easiest and people who understand my L1 understand what I want to communicate the best. Therefore, this is my strongest language:

Order of strength of language	Language
L1 / strongest language	
L2 / second strongest language	
L3 / third strongest language	
L4 / fourth strongest language	
L5 / fifth strongest language	

12 Please list all the languages you know in the order that you learnt them. In other words, I learnt L1 first, L2 second etc.:

Order of acquisition	Language
L1 / language I learnt first	
L2 / language I learnt second	
L3 / language I learnt third	
L4 / language I learnt fourth	
L5 / language I learnt fifth	

In the following section, you are asked the same set of questions about your first and second language. You will be asked to answer these questions in the order of your proficiency / ability in these languages. In other words, you will first think about the language you are the most proficient / strongest in, then the language you feel you are second strongest in etc.

Remember, your strongest language is the language that is the easiest for you to use to express yourself, and people who know your L1 understand what you want to communicate with ease in this language.

13 L1 / my strongest language

This is the language I am the **most proficient** in, or **my strongest language**. All questions below refer to my knowledge of:

Note:

L1, L2 etc. refers to your perception of your relative abilities / proficiency of these languages in your life, not to language you learnt first, second etc.

13.1 Age when I ...

began acquiring L1	became fluent in L1	began reading in L1	became fluent reading in L1	began writing L1	became fluent writing in L1

13.2 Please list the number of years and months you spent in a language environment where your strongest language / L1 is used.

Environment	Years	Months
Country / Community where L1 is spoken		
Family where L1 is spoken		
School where L1 is spoken		

13.3 Please indicate how you learnt your strongest language or the language you are the most proficient in. If you learnt the language in both ways, please indicate both options with a cross (X) or tick (✓).

	Informally (E.g. at home, from family or friends etc.)	Formally (E.g. at school, by attending a formal course etc.)
I learnt my strongest language ...	1	2

Any comments about how you learnt your strongest language?

13.4 On a scale from 1 to 4, please select your level of proficiency for each of the following skills in your strongest language / L1.

Not very good	1	2	3	4	Very good
----------------------	----------	----------	----------	----------	------------------

Language Skill	Proficiency rating in L1
Speaking	
Listening / understanding spoken language	
Reading	
Writing	

13.5 On a scale from 1 to 4, please select how much the following factors contributed to you learning your strongest language / L1.

Did not contribute a lot	1	2	3	4	Contributed a lot
---------------------------------	----------	----------	----------	----------	--------------------------

Factor	Rating of contribution of factor in learning L1
Interacting with friends	
Interacting with family	
Reading	
Language tapes / self-instruction	
Watching TV	
Watching TV and reading subtitles	
Listening to the radio / music	
Used at school / for education	

13.6 Please rate to what extent you are currently exposed to your strongest language / L1 in the following contexts:

Not exposed a lot	1	2	3	4	Exposed a lot
-------------------	---	---	---	---	---------------

Factor	Rating of contribution of factor in learning L1
Interacting with friends	
Interacting with family	
Reading	
Language tapes / self-instruction	
Watching TV	
Watching TV and reading subtitles	
Listening to the radio / music	
Used at school / for education	

14 L2 / my second strongest language

This is the language I am the **second most proficient** in, or **my second strongest language**. All questions below refer to my knowledge of:

Note:

L1, L2 etc. refers to your perception of your relative abilities / proficiency of these languages in your life, not to language you learnt first, second etc.

14.1 Age when I ...

began acquiring L2	became fluent in L2	began reading in L2	became fluent reading in L2	began writing L2	became fluent writing in L2

14.2 Please list the number of years and months you spent in a language environment where your second strongest language / L2 is used.

Environment	Years	Months
Country / Community where L2 is spoken		
Family where L2 is spoken		
School where L2 is spoken		

14.3 Please indicate how you learnt your second strongest language or the language you are the second most proficient in. If you learnt the language in both ways, please indicate both options with a cross (X) or tick (✓).

	Informally (E.g. at home, from family or friends etc.)	Formally (E.g. at school, by attending a formal course etc.)
I learnt my second strongest language ...	1	2

Any comments about how you learnt your second strongest language?

14.4 On a scale from 1 to 4, please select your level of proficiency for each of the following skills in your second strongest language / L2.

Not very good	1	2	3	4	Very good
----------------------	----------	----------	----------	----------	------------------

Language Skill	Proficiency rating in L2
Speaking	
Listening / understanding spoken language	
Reading	
Writing	

14.5 On a scale from 1 to 4, please select how much the following factors contributed to you learning your second strongest language / L2.

Did not contribute a lot	1	2	3	4	Contributed a lot
---------------------------------	----------	----------	----------	----------	--------------------------

Factor	Rating of contribution of factor in learning L2
Interacting with friends	
Interacting with family	
Reading	
Language tapes / self-instruction	
Watching TV	
Watching TV and reading subtitles	
Listening to the radio / music	
Used at school / for education	

14.6 Please rate to what extent you are currently exposed to your second strongest language / L2 in the following contexts:

Not exposed a lot	1	2	3	4	Exposed a lot
--------------------------	----------	----------	----------	----------	----------------------

Context	Rating of exposure to L2 in context
Interacting with friends	
Interacting with family	
Reading	
Language tapes in lab / self-instruction	
Watching TV	
Watching TV and reading subtitles	
Listening to the radio / music	
Used at school / for education	

15 Rate how well you agree with the following statements when thinking about your strongest languages using the following scale:

Disagree	1	2	3	4	Agree
-----------------	----------	----------	----------	----------	--------------

Perception of proficiency of language known	Language (please write in the name of the language)	I like to speak this language	I feel confident using this language	I think it is important to be good at this language	This language forms part of who I am (my identity)
The language I feel I am the most proficient in is ...					
The language I feel I am the second most proficient in is					
The language I feel I am the third most proficient in is ...					

16 Which languages do you use for the following activities and for how many times per week?

Activity	Language	Times per week
Reading for fun		
Reading for studies		
Reading on the Internet		
Writing emails to friends		
Writing for my studies		
Watching TV		
Watching TV and reading subtitles		
Watching films and reading subtitles		
Watching foreign films and reading subtitles		
Listening to the radio / music		
Talking with family (in person and on phone)		
Talking with friends (in person and on phone)		

17 In general, how well do you LIKE to learn new languages?

Dislike

1	2	3	4
---	---	---	---

 Like

18 In general, how EASY do you find learning new languages in comparison to fellow pupils in your class that completed matric / Grade 12 with you?

Difficult

1	2	3	4
---	---	---	---

 Easy

SECTION C: Audiovisual means of communication

Please put a cross (X) or a tick (✓) in the block that represents the appropriate answer at the following questions, or write down an answer.

19 Do you have access to a television at home?

Yes	1
No	2

20 Please look at the grid below and mark ALL the channels / networks you have access to at home.

SABC1	1
SABC2	2
SABC3	3
E-TV	4
MNET	5
DSTV	6
Other (please specify):	

21 Please rate the type of LOCAL programmes you like to watch on television.

Dislike	1	2	3	4	Like
---------	---	---	---	---	------

Type of programme on television	Rating of how you like to watch this type of programme
Soap opera	
Magazine / Lifestyle	
Documentary	
Sport	
News	
Drama / Comedy	

22 Please rate the type of IMPORTED programmes you like to watch on television.

Dislike	1	2	3	4	Like
----------------	----------	----------	----------	----------	-------------

Type of programme on television	Rating of how you like to watch this type of programme
Soap opera	
Magazine / Lifestyle	
Documentary	
Sport	
News	
Drama / Comedy series	
Films	
Foreign films	

23 Do you prefer to watch LOCAL programmes with or without subtitles?

With	1
Without	2

24 Do you prefer to watch IMPORTED programmes with or without subtitles?

With	1
Without	2

SECTION D: Reading subtitles

Please put a cross (X) or a tick (✓) in the block that represents the appropriate answer at the following questions, or write down an answer.

25 Please rate how often you read L1 subtitles when watching television.

Do not read L1 subtitles a lot	1	2	3	4	Read L1 subtitles a lot
--------------------------------------	---	---	---	---	----------------------------

** Please not that L1 is the language you are the most proficient in, or your strongest language.*

Any comments about reading subtitles in your L1?

26 Please rate how often you read L2 subtitles when watching television.

Do not read L2 subtitles a lot	1	2	3	4	Read L2 subtitles a lot
--------------------------------------	---	---	---	---	----------------------------

** Please note that L2 is the language you are the second most proficient in, or your second strongest language.*

Any comments about reading subtitles in your L2?

27 In general, how much do you LIKE to read subtitles on television?

Dislike	1	2	3	4	Like
---------	---	---	---	---	------

28 I first started reading subtitles when I was _____ years old.

29 Please rate how easy / difficult it is for you to read subtitles. Choose ONE.

Extent of reading subtitles	Choose the statement that best describes you
I cannot read any part of the subtitle before it goes off the screen	1
I start reading the subtitle but cannot finish before it goes off the screen	2
I can read most of a subtitle before it goes off the screen	3
I can read the whole subtitle before it goes off the screen	4

30 Please rate to what extent you feel subtitles help you to understand the programme or film you are watching. Choose ONE.

Understanding of the film or programme	Rating of the help of subtitles
The subtitles never help me to understand what I'm watching.	1
Sometimes the subtitles help me to understand what I'm watching.	2
The subtitles always help me to understand what I'm watching.	3
I need the subtitles to understand what I'm watching.	4

31 Please rate to what extent you think subtitles can help the community.

Disagree	1	2	3	4	Agree
-----------------	----------	----------	----------	----------	--------------

Ways of helping the community	Rating of how subtitles can help the community
Subtitling helps deaf/hard-of-hearing viewers to watch television or films	
Subtitling helps develop reading speed	
Subtitling helps all kinds of viewers to understand what they're watching	
Subtitling contributes to the learning of languages, especially English	

32 Please rate to what extent you think subtitles can help you learn.

Disagree	1	2	3	4	Agree
-----------------	----------	----------	----------	----------	--------------

Ways of helping you learn	Rating of how subtitles can help you learn
Subtitling helps me read faster	
Subtitling helps me pronounce English words that I am unfamiliar with	
Subtitling helps me understand what I'm watching	
Subtitling helps me express myself better in English	

33 What do you think of current South African subtitling? Please rate the statements below. Choose ONE.

South African subtitling is...	Rating of current South African subtitling
Excellent – it is perfect, I get everything I need from reading the subtitles.	
Sufficient – it is not great, but it is ok.	
Adequate – it is generally all right but I think it can improve in some aspects.	
Insufficient – it needs to be improved.	

Any comments about South African subtitling?

END OF QUESTIONNAIRE.

Thank you for your time

APPENDIX H

Subtitled film shown to participants

[DVD]

*Permission was obtained from Cavilam to publish the short film, Tadeus,
as an addendum to this study.*

