The effect of frequency of augmented input on the auditory comprehension of narratives for persons with Wernicke's aphasia

by

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Abstract

Augmented input refers to the support of any form of linguistic or visual strategies to enhance understanding during intervention. Previous research predominantly focused on the various types of augmented input that can be used, especially to support reading comprehension. The purpose of this study was to determine and compare the effect of varying amounts of augmented input using partner-pointing on the accuracy of auditory comprehension for persons with Wernicke's aphasia specifically. The research was conducted with seven participants with Wernicke's aphasia. The participants listened to three narratives in three conditions, namely 0%, 50% and 100% augmented input with partner-pointing, and then responded to comprehension items based on the narratives. Most participants had more accurate scores during the 50% augmented input condition. In addition, participants did significantly better in the 50% condition than in the 100% augmented input condition. The main clinical implication is that supporting narrative auditory comprehension with augmented input, used as pre-task and during-task stimulation, seems to facilitate the improved auditory comprehension of narratives for some persons with Wernicke's aphasia. However, providing augmented input for all the content units of a narrative seems to have a negative effect on the auditory comprehension of some persons with Wernicke's aphasia. Continued research is necessary to determine what types and frequency of augmented input will lead to improved auditory comprehension for persons with aphasia, specifically Wernicke's aphasia.

Keywords: alternative and augmentative communication, auditory comprehension, augmented input, resource allocation theory, stroke, Wernicke's aphasia

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Glossary

Augmented input: The support of any linguistic or visual strategies, employed by the communication partner, that enhance the comprehension of a person with aphasia

Augmented input with partner-pointing. The process of referencing text to match auditory with visual input. In this study, it specifically refers to the communicaiton partner pointing to relevant Picture Communication Symbols (PCS) as a narrative is read

During-task stimulation. Augmented input employed during the experimental task. In this study, both the high-context photograph and the no-context PCS images remained in front of the participant during the reading of the narrative as during-task stimulation

High-context images. Images that include a natural environment with interaction among the portrayed people, animals, objects, and the environment

Linguistic support. Auditorily or visually presented information relating to the target information. It is not in the form of images or gestures, but rather in the form of written keywords or prosodic emphasis used to supplement the expression, comprehension and cognition of persons with aphasia

No-context images. Images that portray separated people or objects against a neutral background

Pre-task stimulation. Augmented input employed before the experimental task. In this study, the participants were shown both the high-context photograph and the no-context PCS images as pre-task stimulation for one minute. They were informed that the images provided some information regarding the narrative that would follow

Visual support. Gestures or visuographic images, such as photographs or line drawings, used to supplement the expression, comprehension and cognition of persons with aphasia

The effect of frequency of augmented input on the auditory comprehension of narratives for persons with Wernicke's aphasia

Following a stroke, up to 70% of people with aphasia (PWA) experience some degree of auditory comprehension difficulties (Robson, Keidel, Lambon Ralph, & Sage, 2012). Wernicke's aphasia represents approximately 13% of the aphasia population struggling with comprehension (Garrett & Richman, 2007). Persons with Wernicke's aphasia typically present with damage to the left posterior temporo-parietal cortex (Robson, Grube, Lambon Ralph, Griffiths, & Sage, 2013). This area in the brain involves phonological, semantic and auditory processing. Thus, Wernicke's aphasia is characterized by impaired repetition and speech. In addition, severely impaired auditory comprehension is typically observed, as working phonological analysis abilities are needed to recognize spoken words (Robson et al., 2013; Robson et al., 2014).

Any PWA with impairments in auditory comprehension may experience frustration and isolation, have an increased dependence on significant others and be subject to medical misdiagnoses (Garrett & Richman, 2007; Wallace, Dietz, Hux, & Weissling, 2012). Poor auditory comprehension may also result in an inability to benefit from feedback or instructions, which can lead to a lack of improvement within the therapeutic process (Garrett & Richman, 2007). As Wernicke's aphasia is in fact known as a "quintessential" comprehension disorder (Thompson, Robson, Lambon Ralph, & Jefferies, 2015), these difficulties experienced with poor auditory comprehension hold true specifically for persons with Wernicke's aphasia.

Despite these impairments, research has shown that the capacity of persons with Wernicke's aphasia to understand visual modalities, such as photographs and images, is relatively preserved (Robson, Sage, & Lambon Ralph, 2012; Thompson et al., 2015). In fact, the comprehension of written words, which is facilitated by both visual and linguistic processes, is

significantly less impaired in persons with Wernicke's aphasia than their auditory modalities (Robson, Sage, et al., 2012; Thompson et al., 2015). Persons with Wernicke's aphasia may therefore benefit from the advances and application of comprehension support techniques to address impairments that persist regardless of traditional restorative therapy (Wallace et al., 2012).

Alternative and Augmentative Communication

Due to lasting impairments post-stroke, many PWA need a variety of alternative and augmentative communication (AAC) strategies to support functional communication (Johnson, Hough, King, Vos, & Jeffs, 2008). According to Brown and Thiessen (2018), AAC serves to provisionally or permanently substitute natural speech or to supplement auditory and written language comprehension or expression in PWA.

Augmented input. To enhance understanding and improve communicative effectiveness, compensatory strategies are needed to augment comprehension in PWA (Brennan, Worrall, & McKenna, 2005; Wallace et al., 2012). Augmented input refers to the support of any linguistic or visual strategies, employed by the communication partner, that enhance the comprehension of the PWA (Dada, Stockley, Wallace, & Koul, 2019; Garrett & Richman, 2007; Wallace et al., 2012). Auditory comprehension is supported by augmented input strategies through highlighting prominent information provided by the communication partners, thereby reducing the cognitive load and amplifying former knowledge (Wallace et al., 2012; Wood, Lasker, Siegel-Causey, Beukelman, & Ball, 1998). Information is therefore provided by multiple modalities, for example spoken language being supplemented by another modality such as text or gestures (Wallace et al., 2012; Wallace, Knollman-porter, Brown, & Hux, 2018; Wood et al., 1998).

Augmented input can be divided into two categories, namely visual and linguistic support (Griffith, Dietz, & Weissling, 2014; Wallace et al., 2012).

Visual supports. When gestures or visuographic images, such as photographs or line drawings, are used to supplement the expression, comprehension and cognition of PWA, it is referred to as visual supports (Brown & Thiessen, 2018; Griffith et al, 2014; Wallace et al., 2012). Visual supports aid language comprehension by reducing the dependence on deficient language systems, and taking advantage of the moderately preserved visual processing abilities of PWA (Brown & Thiessen, 2018). Research has shown that many PWA with persistent speech and language impairments are still able to recognize visual supports, which can supplement both their expression and their comprehension of language (Beukelman, Hux, Dietz, McKelvey, & Weissling, 2015; Dietz, Hux, McKelvey, Beukelman, & Weissling, 2009; Fried-Oken, Beukelman, & Hux, 2012; Hux, Buechter, Wallace, & Weissling, 2010; Petroi, Koul, & Corwin, 2014; Wallace et al., 2012; Wallace, Hux, Brown, & Knollman-Porter, 2014). Researchers also found that contextual photographs or images aid reading comprehension of narratives (Dietz et al., 2009; Dietz, Knollman-Porter, Toth, & Brown, 2014; King & Simmons-Mackie, 2017; McKelvey, Hux, Dietz, & Beukelman, 2010).

Linguistic supports. Wallace et al. (2012, p. 163) define linguistic supports as "auditorily or visually presented information relating to the target information". For example, when PWA are provided with the linguistic support of *holiday* (written and/or spoken), they might understand the target sentence, *We went to the beach every day*, better. Unlike visual support, linguistic support is not in the form of images or gestures, but rather as written keywords or prosodic emphasis used as augmented input (Dietz et al., 2014; Garrett & Beukelman, 1995; Griffith et al., 2014; Wallace et al., 2012). Garret, Lasker and Smith (2007) specifically found

that using text facilitated improved communication for PWA. This supports the use of the Written-choice Communication Strategy (Garrett & Beukelman, 1995) for example. This strategy is a conversational technique where communication partners provide written word choices to PWA and then allow them to choose appropriate responses from a written array. Garrett and Beukelman (1995) and Lasker, Hux, Garrett, Moncrief and Eischeid (1997) demonstrated that it improves the quality of communicative interactions between the PWA and their communication partner by combining auditory and visual modalities to strengthen comprehension.

Systematic Search for Augmented Input Studies with Persons with Aphasia

To explore what forms of augmented input improve the language skills of PWA the most, a systematic search of augmented input studies was done. The aim of the systematic search was to identify studies that investigated different types of augmented input used to facilitate improved expressive and receptive language skills for persons with aphasia. The search was done to determine what types of augmented input are used to facilitate improved language skills for PWA, as well as to describe the reported effect on the language skills of PWA.

The terms searched were “persons with aphasia” OR “aphasia” OR “stroke” OR “CVA” AND “augmented input” OR “AAC” OR “alternative AND augmentative communication” OR visual strateg*” OR “visual support*” OR “visuographic image*” OR “visual scene*” OR “graphic” OR “symbol*” OR “gesture*” OR “manual sign*” OR “Likert scale*” OR “line drawing*” OR “photograph*” OR “linguistic strateg*” OR “written keyword*” OR “written choice strategy” OR “written support*” OR “written material” OR “written information” OR “text” OR “aided language” OR “partner support*” OR “partner pointing” OR “communication board” OR “communicat* support*” AND “communication” OR “expressive language” OR

"oral expression" OR "output" OR "production" OR "speech" OR "reading" OR "understanding" OR "comprehension" OR "receptive language".

The databases searched were EBSCOhost, Medline, CINAHL, ERIC, psychINFO and Health Source: Nursing/Academic Edition. Additional articles were found from identified articles through a hand search conducted by the researcher. The inclusion criteria were the following: (i) a peer-reviewed article, (ii) published in English, between 2003 and 2018, (iii) describing aided or unaided augmented input aiming to improve receptive or expressive language, (iv) for PWA post-stroke, above the age of 18, (v) using an experimental or quasi-experimental study design.

Using the above-mentioned keywords and databases resulted in the identification of 338 articles (Figure 1). These articles were screened at title level using the selection criteria described above. Five duplicates were removed, 125 articles were excluded for not including PWA post-stroke and 178 articles were excluded for not including augmented input. The 30 remaining articles from the database search were scanned at abstract level. Nine (9) articles were excluded for not including experimental or quasi-experimental designs, and 11 articles were excluded for not including augmented input. This left a total of 10 articles identified by means of the database search. Five (5) articles were identified by means of hand searches and forward citation. A total of 15 articles were identified in the systematic search and are summarized in Table 1.

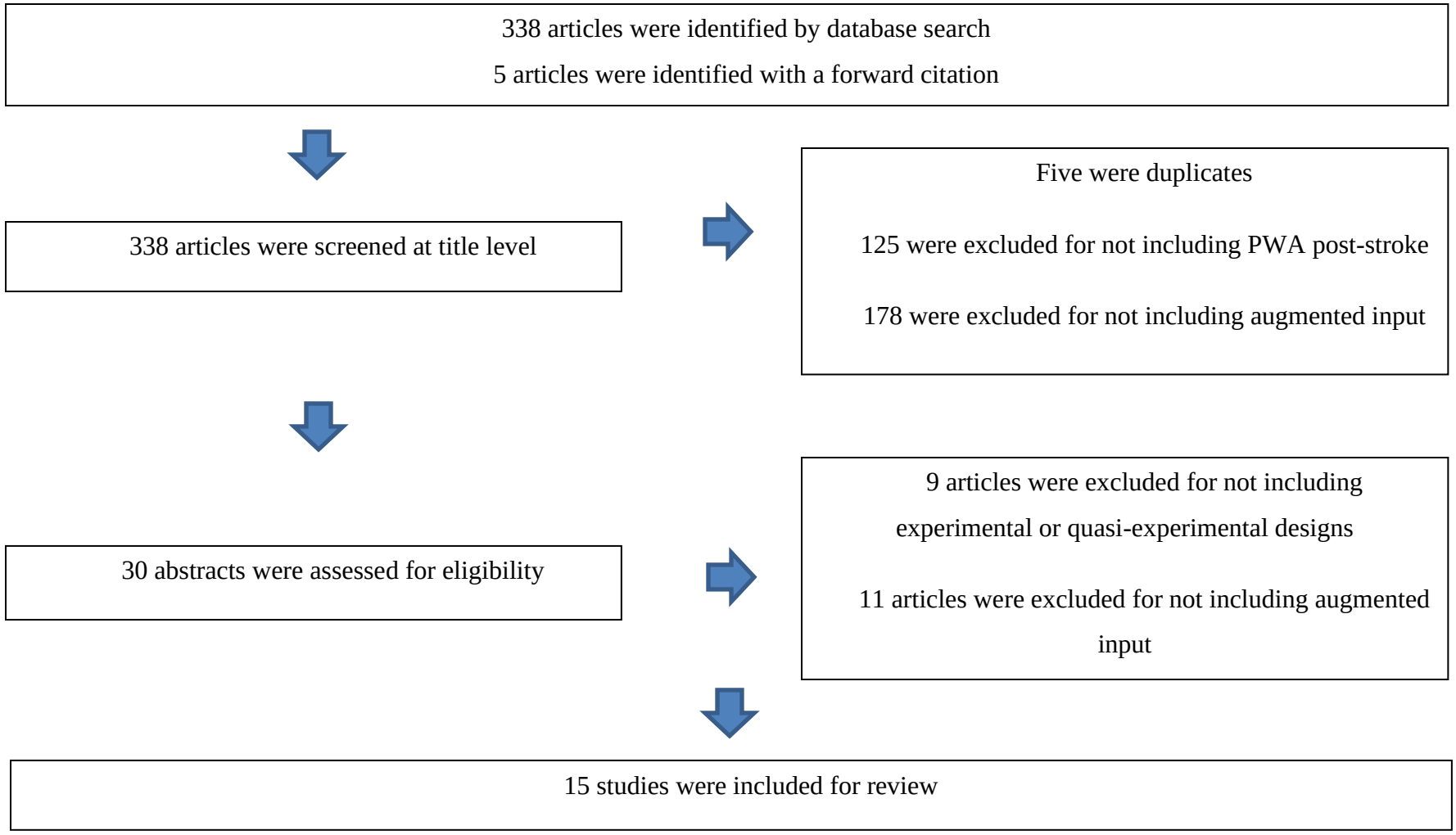

Figure 1. Systematic search process for studies included in systematic search illustrated using the PRISMA flow diagram (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group, 2010)

Table 1

Systematic search of experimental augmented input studies

Article number	Publication date and authors	Title of article	Aim of the study	Study design	Participant characteristics	Augmented input characteristics	Task characteristics	Outcomes measured	Results
1	Brennan et al., 2005	The relationship between specific features of aphasia-friendly written material and comprehension of written material for people with aphasia	To explore the effects of aphasia-friendly formats on reading comprehension of PWA.	Exploratory experimental	Nine (9) participants with mild to moderate chronic aphasia secondary to a cerebrovascular accident (CVA) (3 females and 6 males)	Both visual (images) and linguistic supports (text) were used for reading comprehension. Each paragraph was modified either by being augmented by (i) pictures (clipart), (ii) simple vocabulary and syntax, (iii) large print, (iv) increased white space, (v) all the above (aphasia-	Participants read paragraphs at three different reading levels, each modified with one of the six conditions.	Comprehension of the written material was measured with the participant choosing the best word or phrase to complete the final sentence of each paragraph from a possibility of four options.	This study has suggested that including pictures may not significantly improve reading comprehension, whereas using simplified vocabulary and syntax, large print, and increased white space is more significantly effective. However, it may be premature to reject the use of pictures in aphasia-friendly formatting, as there was significant benefit in using all four

Article number	Publication date and authors	Title of article	Aim of the study	Study design	Participant characteristics	Augmented input characteristics	Task characteristics	Outcomes measured	Results
						friendly) or (vi) none of the above (control paragraphs).			formatting principles simultaneously (including pictures).
2	Dietz et al., 2009	Reading comprehension by people with chronic aphasia: A comparison of three levels of visuographic contextual support	To explore the impact of three levels of visuographic support – (a) high-context photographs, (b) low-context photographs, and (c) no photographs – on the reading comprehension of narratives by people with chronic aphasia.	Repeated measures design	Seven (7) adults with chronic Broca's aphasia (4 females and 3 males)	Visual support (high- and low-context photographs) was used for reading comprehension.	Participants read three narratives, each presented with a different level of visuographic support. Then participants had to answer comprehension questions based on the narratives.	The researchers examined (a) reading comprehension response accuracy (measured in number of correct responses), (b) response time (measured in seconds), and (c) the participants' perceptions of image helpfulness.	The study found that there was an increased response accuracy when either type of visuographic support was present. Participants demonstrated significantly faster response times in the no-photographs condition than in the high- and low-context conditions. Participants perceived the tasks as easier when they read narratives paired with high context.

Article number	Publication date and authors	Title of article	Aim of the study	Study design	Participant characteristics	Augmented input characteristics	Task characteristics	Outcomes measured	Results
3	Rose, Worrall, Hickson, & Hoffmann, 2011	Exploring the use of graphics in written health information for people with aphasia	To determine if black and white line drawings and colour photographs affect the reading comprehension of people with and without aphasia, and to explore perceptions of graphic helpfulness and preferences for printed education material (PEM).	Repeated measures design	Twenty-two (22) PWA (18 with anomic, 2 with conduction, and 2 with Broca's aphasia – 9 females and 13 males) and 15 of their partners	Visual supports (line drawings or photographs) were used for reading comprehension. Response options contained (i) no illustrations, (ii) black and white line drawings, or (iii) colour photographs.	Participants completed a purposefully developed cloze reading comprehension task, with multiple- choice response options with the different visual supports. The reading comprehension task was timed.	Participants' reading comprehension of written material was measured by the number of accurate responses to the comprehension questions after reading PEM with either the support of black and white line drawings or colour photographs.	There were no significant differences on the reading comprehension task for PWA and those without. In contrast, most participants perceived that pictures helped in understanding and made reading quicker. Significantly more participants with aphasia, compared to participants without, reported that they needed pictures to understand writing, and all participants with aphasia preferred health information to

Article number	Publication date and authors	Title of article	Aim of the study	Study design	Participant characteristics	Augmented input characteristics	Task characteristics	Outcomes measured	Results
									contain graphics. Several participants did not prefer line drawings or photographs in PEMs.
4	Wallace et al., 2012	Augmented input: The effect of visuographic supports on the auditory comprehension of people with chronic aphasia	To determine the effect of visuographic supports on the auditory comprehension of people with chronic aphasia.	Repeated measures design	Twenty-one (21) participants with chronic aphasia (8 with anomic, 2 with conduction, 5 with Broca's, 3 with Wernicke's and 2 with transcortical aphasia – 6 females and 15 males)	Visual supports (photographs and drawings) were used for auditory comprehension. The different conditions were (i) no-context photographs, (ii) low-context drawings with embedded no-context photographs, (iii) high-context photographs,	Participants listened to four stories, one in each of the four conditions. Thereafter, they had to respond to 15 multiple-choice sentence completion statements related to each story.	The effect of four non-personalized visuographic image conditions on the auditory comprehension of people with chronic aphasia was measured by assessing participants' accuracy in responding to 15 multiple-choice sentence completion	Results showed no significant differences in response accuracy across the four visuographic conditions during a narrative auditory comprehension task.

Article number	Publication date and authors	Title of article	Aim of the study	Study design	Participant characteristics	Augmented input characteristics	Task characteristics	Outcomes measured	Results
						(iv) or no visuographic support.		statements after listening to narratives in each condition.	
5	Caute et al., 2013	Enhancing communication through gesture and naming therapy	To investigate whether gesture, naming and strategic treatment improve the communication skills of 14 people with severe aphasia.	Repeated measures design	Fourteen (14) people with severe aphasia (7 females and 7 males)	Visual support (gestures) was used for communication enhancement.	Participants received 15 hours of gesture and naming treatment to train a vocabulary of 20 gestures and 20 different words.	The effects of therapy on communication were assessed with two novel measures. The message assessment required participants to convey a simple request, question or statement to their partners. The narrative assessment required participants to convey a	The results suggest that gesture and naming treatment increases the performance of expressive language tasks since scores increased following training, having been stable since the baseline measures. Furthermore, this pattern was observed in both the message and narrative assessments. Thus, it seemed that training in a vocabulary of gestures and words increased

Article number	Publication date and authors	Title of article	Aim of the study	Study design	Participant characteristics	Augmented input characteristics	Task characteristics	Outcomes measured	Results
								sequence of ten linked events using six silent videos as stimuli.	participants' ability to convey information to their partners.
6	Dietz et al., 2014	Supported reading comprehension for PWA: Visual and linguistic supports	To determine the effect of no support, visual support (photograph) and linguistic support (keywords and headings) used as pre-task and during-task stimulation, on reading comprehension of PWA.	Repeated measures design	A total of 17 participants (12 with non-fluent aphasia and 5 with fluent aphasia) secondary to a left CVA (9 females and 8 males)	Visual support (photographs) and linguistic support (keywords and headings) were used for reading comprehension. The different conditions were (i) no support, (ii) heading, (iii) keywords or (iv) photograph.	Participants were required to read each of the stories in each of the four conditions and respond to a set of 15 cloze statements, each with 4 possible response choices that corresponded to each story.	Participants' reading comprehension was measured by the number of accurate responses to the cloze statements.	Participants showed significantly better reading comprehension of narratives when given photographs versus keywords as augmented input.
7	Wallace et al., 2014	High-context images: Comprehension of main,	To compare the accuracy and speed with which people	Repeated measures design	Twenty (20) people with chronic aphasia (8	Visual support (high-context images) was used for	Participants were required to listen to spoken sentences and	The researchers measured the auditory comprehension	Task performance by participants without aphasia was more accurate and faster

Article number	Publication date and authors	Title of article	Aim of the study	Study design	Participant characteristics	Augmented input characteristics	Task characteristics	Outcomes measured	Results
		background, and inferential information by people with aphasia	with and without aphasia derive main action, background, and inferential information from high-context images.		with anomic, 10 with Broca's, 1 with conduction and 1 with Wernicke's aphasia – 12 females and 8 males), and 20 age-matched control participants without aphasia	auditory comprehension.	select a target image from a field of four.	of PWA in comparison with people without aphasia, by comparing the accuracy and speed with which they derive main action, background, and inferential information from high-context images.	than that of PWA regardless of sentence condition. The PWA were significantly slower and less accurate when selecting high-context images to match sentences relaying background and inferential information than ones relaying main action information. The results suggest that many PWA can derive substantial information from high-context images.
8	Eggenberger et al., 2016	Comprehension of co-speech gestures in aphasic patients:	To investigate the influence of congruence between speech and co-speech	Repeated measures design	Twenty (20) aphasic patients (8 with Broca's, 4 with anomic,	Visual support (gestures) was used for speech and gesture comprehension.	Participants watched videos in which speech was either combined with	Comprehension of speech and gestures was measured by means of a	Co-speech gestures play an important role for aphasic patients as they modulate

Article number	Publication date and authors	Title of article	Aim of the study	Study design	Participant characteristics	Augmented input characteristics	Task characteristics	Outcomes measured	Results
		An eye movement study	gestures on comprehension in terms of accuracy in a decision task.		2 with global and 6 with Wernicke's aphasia – 7 females and 13 males) and 30 healthy controls		meaningless (baseline condition), congruent (speech and gesture having the same meaning), or incongruent gestures (speech combined with a non-matching, but semantically, meaningful gesture).	decision task, while remote eye-tracking allowed analysis of visual exploration.	comprehension. Incongruent gestures evoke significant interference and deteriorate patients' comprehension. In contrast, congruent gestures enhance comprehension in aphasic patients.
9	Wilson & Read, 2016	Do particular design features assist PWA to comprehend text? An exploratory study	To examine the effects of specific design features on text comprehension. It was hypothesized that font style,	Repeated measures design	Nine (9) participants with mild to moderate aphasia (3 females and 6 males)	Visual support (images) and linguistic support (text) were used for reading comprehension	Participants read 35 paragraphs and selected the most appropriate word or phrase from a choice of	Reading comprehension of paragraphs was assessed in three conditions: font style, letter case and text with a	PWA comprehended significantly more written information that is presented in a sans-serif font than in a serif style, and when presented in lower case than in

Article number	Publication date and authors	Title of article	Aim of the study	Study design	Participant characteristics	Augmented input characteristics	Task characteristics	Outcomes measured	Results
			letter case and supporting images would all have a significant impact on the ability of PWA to comprehend text.				four to finish the final sentence.	supporting image.	upper case. The inclusion of a single supporting image to illustrate a paragraph of text did not have a significant effect on comprehension.
10	Hux, Knollman-Porter, Brown, & Wallace, 2017	Comprehension of synthetic speech and digitized natural speech by adults with aphasia	To compare the preferences and auditory comprehension accuracy of PWA when listening to sentences generated with digitized natural speech, Alex synthetic speech (i.e., Macintosh platform), or David synthetic	Repeated measures design	Twenty (20) participants with chronic aphasia (1 with global, 1 with Wernicke's, 6 with conduction, 4 with Broca's, and 8 with anomic aphasia – 9 females and 11 males)	Linguistic support (synthetic and digitized speech) was used for auditory comprehension. The three conditions consisted of (i) digitized natural speech, (ii) Alex synthetic speech (i.e., Macintosh	Participants listened to sentences in each of the stimulus sets.	Auditory comprehension was measured by means of the accuracy with which the participants selected one of four images corresponding in meaning to each of 60 sentences comprising the	Results revealed significantly better accuracy given digitized natural speech than either synthetic speech option when having to select one of four images corresponding in meaning to a sentence.

Article number	Publication date and authors	Title of article	Aim of the study	Study design	Participant characteristics	Augmented input characteristics	Task characteristics	Outcomes measured	Results
			speech (i.e., Windows platform).			platform), or (iii) David synthetic speech (i.e., Windows platform).		three stimulus sets.	
11	Ulmer, Hux, Brown, Nelms, & Reeder, 2017	Using self-captured photographs to support the expressive communication of people with aphasia	To analyze the performance of individuals with aphasia as they observed, captured photo-graphs of and later participated in a conversation with a novel communication partner about a series of demonstrated wellness activities.	Experimenta l multiple case study design	Five (5) adults with chronic aphasia (2 with anomic, 2 with Broca's and 1 with Wernicke's aphasia)	Visual support (photographs) was used for expressive communication.	Participants observed research team members performing wellness activities and took photographs, as desired, throughout the process. Each participant then engaged in a conversation about the observed wellness activities while	Expressive communication was then measured in (i) number of spontaneous image use to support conversation or relay novel information, (ii) number of content units generated and (iii) success with topic maintenance.	Participants varied in number of photographs captured, spontaneous image use to support conversation, and success in relaying novel information to an unfamiliar partner. Participants who referenced photographs generated more content units with greater specificity than participants who did not reference photographs.

Article number	Publication date and authors	Title of article	Aim of the study	Study design	Participant characteristics	Augmented input characteristics	Task characteristics	Outcomes measured	Results
							having access to captured photographs.		
12	Van Nispen, Van de Sandt-Koenderman, Sekine, Krahmer, & Rose, 2017	Part of the message comes in gesture: How PWA convey information in different gesture types as compared with information in their speech	To investigate the contribution of gestures to the communication of PWA. They specifically focused on the degree to which different gesture types and representation techniques convey information absent in the speech of PWA.	Exploratory experimental design	Forty-six (46) PWA (18 females and 28 males) and 9 non-brain-damaged participants (NBDP)	Visual support (gestures) was used for expressive language.	The researchers studied the gestures produced by the PWA and the nine NBDP during semi-structured conversation.	For each of the different types of gestures and representation techniques, they identified whether this conveyed essential information (that is information that was absent in speech).	Despite individual differences between PWA, the majority produced more essential gestures than NBDP, who produced limited amounts of essential gestures.
13	Brown, Wallace, Knollman-	Comprehension of single versus multiple modality	To determine the comprehension benefits for	Repeated measures design	Twenty-seven (27) adults with aphasia (mild,	Linguistic support (text and/or spoken words) was used	The participants read and/or listened to sentence stimuli	Participants' comprehension was measured by the number	Participants demonstrated significantly greater accuracy during the

Article number	Publication date and authors	Title of article	Aim of the study	Study design	Participant characteristics	Augmented input characteristics	Task characteristics	Outcomes measured	Results
	Porter, & Hux, 2018	information by people with aphasia	people with mild, moderate, and severe aphasia when hearing, reading or simultaneously hearing and reading single sentences.		moderate and severe aphasia)	for reading and auditory comprehension.	and selected the one matching the sentence from four images.	of accurate responses after hearing, reading, or simultaneously hearing and reading single sentences.	combined modality (text and spoken word support) than during the single modality conditions (text or spoken words alone).
14	Wallace et al., 2018	Narrative comprehension by PWA given single versus combined modality presentation	To examine comprehension accuracy and reviewing time for PWA when processing short and long paragraph-length narratives in auditory only, written only, and combined auditory and	Repeated measures design	Twenty (20) adults with chronic aphasia	Linguistic support (text) was used for auditory and reading comprehension.	Participants listened to, read or listened to and read (combined) six short and six long narratives.	Comprehension was measured by means of the accuracy with which participants answered 10 multiple-choice questions presented via the Written-choice Communication	Results suggest that presenting multi-sentence narratives through more than one modality may support comprehension for some PWA; however, the effect is not universal and differs depending on the length of material presented.

Article number	Publication date and authors	Title of article	Aim of the study	Study design	Participant characteristics	Augmented input characteristics	Task characteristics	Outcomes measured	Results
			written conditions.					Strategy, after each narrative.	
15	Dada et al., 2019	The effect of augmented input on the auditory comprehension of narratives for persons with chronic aphasia: A pilot investigation	To evaluate the relative effectiveness of two different augmented input conditions in facilitating auditory comprehension of narrative passages.	Repeated measures design	Twelve (12) participants with chronic aphasia (10 with Broca's, 1 with anomic and 1 with conduction aphasia – 4 females and 8 males)	Visual support (high-context photographs and no-context Picture Communication Symbols (PCS) was used to aid auditory comprehension.	Participants listened to two narratives, one in each condition. One condition involved the partner actively pointing (AI-PP) out key content words using visuographic supports. The second condition involved no AI-PP.	Auditory comprehension was measured by assessing participants' accuracy in responding to 15 multiple-choice cloze-type statements related to each narrative.	There was no statistical difference between the two conditions, but AI-PP, using combined high-context and PCS visual supports, improved response accuracy for some persons with chronic aphasia.

Studies focusing on linguistic support. Linguistic support is defined as information that is offered auditorily or visually (graphemes, not images or gestures), and relates to the intended information (Wallace et al., 2012). From Table 1 it is evident that a few studies have specifically investigated the effect of linguistic support such as written keywords or Written-choice Communication Strategy on the language skills of PWA. These studies all aimed to improve receptive language skills.

Linguistic support for receptive language skills. Hux et al. (2017) compared the auditory comprehension accuracy of PWA when listening to sentences generated with digitized natural speech in comparison with different platforms of synthetic speech. The results revealed that digitized natural speech as linguistic support leads to significantly better accuracy in terms of auditory comprehension items.

Brown et al. (2018) examined the use of written information only, auditory information only, and combined written and auditory information to support the comprehension of simple active sentences by PWA. Most participants demonstrated better performance in the combined modality condition by means of average accuracy scores. However, performance varied within the aphasia severity groups. Persons with mild to moderate aphasia showed minimal accuracy differences across conditions, and persons with severe aphasia showed significantly more accurate performances in the combined modality than with the written only condition. The majority reported that they preferred the combined modality condition, although this preference did not always correlate with accuracy.

Taking it one step further, Wallace et al.'s (2018) aim was to evaluate comprehension accuracy and response time for PWA when processing short and long paragraph-length narratives in written only, auditory only, and combined written and auditory conditions. After

each narrative, participants answered ten multiple-choice questions presented by means of the Written-choice Communication Strategy. The researchers also found that presenting multi-sentence narratives through more than one modality may support comprehension for some PWA; however, it depends on the length of the narrative. In support of Brown et al.'s finding, the researchers concluded that the combined modality condition was also the preferred modality.

Studies focusing on visual support. When gestures or visuographic images are used to supplement the expression, comprehension and cognition of PWA, it is referred to as visual supports (Brown & Thiessen, 2018; Griffith et al., 2014; Wallace et al., 2012). A few studies have specifically investigated the effect of visual support on the language skills of PWA. These studies can be divided into those who aimed to improve expressive language and those who aimed to improve receptive language.

Visual support for expressive language skills. Van Nispen et al. (2017) investigated to what extent PWA use gestures to convey essential information; that is, information that was absent in their speech. They found that a great proportion of gestures produced by most PWA convey information essential for understanding their communication. In accordance with this research, Caute et al. (2013) found that gesture and naming treatment improved the ability of PWA to convey simple messages and narratives to their communication partner.

Apart from gestures used as visual support, one study focused on the use of visual support to aid expressive language of PWA. Ulmer et al. (2017) investigated the use of self-captured photographs to support the expressive communication of PWA and found that the PWA who referenced these photographs presented with increased content specificity and topic maintenance during conversations.

Visual support for receptive language skills. Rose et al. (2011) and Dietz et al. (2009) investigated the effect of visual support on the reading comprehension of PWA. Rose et al. (2011) provided a paragraph to be read, with either black and line drawings or colour photographs as support. Participants were then required to choose the single best word to complete the sentence at the end of the paragraph. Similarly, Dietz et al. (2009) provided either high-context photographs, low-context photographs or no photographs together with a narrative to read. Participants were then required to answer comprehension questions about the narrative. Both of these studies made use of the Written-choice Communication Strategy (Garrett & Beukelman, 1995). The results varied across these two studies. Rose et al. (2011) found that there was no significant difference between the accuracy of the answers or the time taken to respond across the different conditions. Dietz et al. (2009), on the other hand, found that participants answered significantly more questions correct in the high-context condition, but with significantly faster response times in the no-context condition. The differences in the results of these two studies may be attributed to the difference in visual materials, in how they tested reading comprehension (sentence completion versus comprehension questions) and in the participant descriptions. Dietz et al.'s study had participants with Broca's aphasia only, while the participants in Rose et al.'s study was more diverse in diagnosis. However, Rose et al.'s participants demonstrated substantially higher scores in terms of language and reading impairments on the same standardized measures as the participants in the Dietz et al. study.

With the focus on gestures as visual support, Eggenberger et al. (2016) had 20 people with chronic aphasia watch videos in which the speech was either combined with meaningless (baseline condition), congruent (speech and gesture having the same meaning) or incongruent (speech combined with non-matching, but semantically meaningful) gestures. Comprehension

was then assessed with a decision task. They found that the incongruent condition resulted in a significant decrease of accuracy, while the congruent condition led to a significant increase in accuracy compared to baseline accuracy. Visual support in the form of gestures seems to improve comprehension in aphasic patients.

In contrast, Wallace et al. (2012) found that visual augmented input in the form of photographs did not influence participants' response accuracy for sentence completion comprehension tasks. A total of 21 PWA listened to four stories, one in each of the four conditions (i.e., no-context photographs, low-context drawings with embedded no-context photographs, high-context photographs, and no visuographic support). Auditory comprehension was then measured by assessing participants' accuracy in responding to 15 multiple-choice sentence completion statements related to each story. Results showed no significant differences in response accuracy across the four visuographic conditions. The authors concluded that including pre-stimulation could possibly have had a positive influence on the results.

Dada et al. (2019) attempted a similar study with 12 participants with chronic aphasia. The researchers looked at referencing text to match auditory with visual input. They referred to this process as augmented input with partner-pointing (AI-PP). The participants listened to two narratives; one condition with AI-PP (the researchers pointing to relevant Picture Communication Symbols (PCS) as the narrative was read) and one with no AI-PP (no active pointing to PCS). Auditory comprehension was then measured by assessing participants' accuracy in responding to 15 multiple-choice cloze-type statements related to the narratives. It was found that partner-referenced no-context PCS images combined with high-context visual support as a form of augmented input, seems to facilitate the improved auditory comprehension of narratives for some persons with chronic aphasia.

Studies focusing on a combination of visual and linguistic support. Few studies specifically investigated the effect of a combination of visual and linguistic support on the receptive language skills of PWA.

A combination of support for receptive language skills. Brennan et al. (2005) and Wilson and Read (2016) both used a clozed reading task to compare comprehension of PWA with the reading of control paragraphs and paragraphs with visual and linguistic support. Interestingly, both studies found no significant improvement in comprehension when pairing images with reading materials for PWA. In contrast, Dietz et al. (2014) found that PWA presented with significantly improved reading comprehension when given photographs in comparison with keywords as augmented input during a reading comprehension task. In addition, most PWA in other studies felt that visual supports benefited their comprehension skills (Dietz et al., 2009; Rose et al., 2011). The type of images used in their experimental tasks may be one probable reason for the difference in findings. In Brennan's (2005) study, line drawings rather than photographic images as visual supports were used, and these drawings might not have been ideal. Wilson and Read (2016) found a higher average number of correct responses for text combined with a photograph, in comparison to text combined with ClipArt.

Studies of augmented input on comprehension of narratives for persons with Wernicke's aphasia. The studies assessing expressive language all pointed towards augmented input being beneficial for PWA within various severity groups. The studies assessing receptive language had more varying results. For example, in the study by Wallace et al. (2012), three of the 21 PWA had Wernicke's aphasia. As expected, the persons with Wernicke's aphasia achieved lower accuracy scores compared to the participants with mild aphasia. The authors noted, however, that the addition of pre-task stimulation as well as combining text and

visuographic images as augmented input may have favourably changed these results. Dietz et al. (2014) supported this idea as their study showed that pre-task stimulation is deemed beneficial for comprehension, while Wallace et al. (2018) supported the idea of combining modalities for improved comprehension. Dada et al. (2019) included pre-task stimulation and frequency of AI-PP in their research. They found that 70% AI-PP improved the accuracy of responses to comprehension items based on narratives for some PWA in comparison to providing no AI-PP during listening tasks. However, there were no persons with Wernicke's aphasia represented in their study.

Interestingly, Brown et al. (2019) found that persons with severe aphasia showed significantly more accurate performances during the combined modality condition than during the written only condition, whereas persons with mild to moderate aphasia showed only a slight accuracy difference across the different conditions. However, the study by Brown et al. focused on sentence and not narrative comprehension. Wallace et al. (2018) had participants representing a wide spectrum of aphasia types and severities and could therefore not analyze the data according to particular aphasia profiles as Brown et al. were able to do. However, the results potentially indicate that varying aphasia types and severities may benefit from multiple modalities as support for comprehension.

It became clear during some of the studies that even though the statistics might not show significant results, the majority of the PWA participants would state that the use high-context images supported their understanding more than keywords did (Dietz et al., 2009, 2014; Rose et al., 2011). Future research is needed to study participants systematically to allow severity analysis, for example targeting only one or two types of aphasia. This is necessary to establish an

evidence base to inform clinical practice regarding what augmented input is beneficial for whom and under what circumstances (Wallace et al., 2018).

In summary, the use of augmented input during comprehension tasks may reduce the dependence on deficient language systems, thereby supporting PWA to better comprehend information (Brown & Thiessen, 2018; Wallace et al., 2012). The variable outcomes across research studies emphasize the necessity of systematically evaluating the auditory comprehension benefits that PWA, especially persons with Wernicke's aphasia, may gain from different frequencies of augmented input. Previous research has predominantly focused on the various types of augmented input that can be used, especially to support reading comprehension; only one study has been done on the frequency of partner-pointing needed to support auditory comprehension of PWA (Dada et al., 2019). Further research is needed to determine what frequency of AI-PP will aid improved auditory comprehension for PWA, specifically persons with Wernicke's aphasia. Therefore, the purpose of this study is to determine and compare the effect of varying amounts of AI-PP on the accuracy of auditory comprehension for persons with Wernicke's aphasia.

Methodology

Research Aims

Main aim. The main aim of the study is to determine the effect of frequency of AI-PP on the auditory comprehension of narratives for persons with Wernicke's aphasia.

Sub-aims. The sub-aims of the study are:

i. To determine the accuracy of responses on auditory comprehension items based on a narrative with 0% AI-PP for persons with Wernicke's aphasia;

ii. To determine the accuracy of responses on auditory comprehension items based on a narrative with 50% AI-PP for persons with Wernicke's aphasia;

iii. To determine the accuracy of responses on auditory comprehension items based on narrative with 100% AI-PP for persons with Wernicke's aphasia; and

iv. To compare the accuracy of responses on auditory comprehension items between the three augmented input conditions for persons with Wernicke's aphasia.

Research Design

An experimental within-subject design was used to determine the effect of either 0, 50 or 100% content unit frequency of AI-PP on the auditory comprehension of the narratives. This design permits each participant to be exposed to every condition in the experiment (Charness, Gneezy, & Kuhn, 2012; Van Breukelen, 2010). Advantages of this design are that there is a smaller risk for error variance associated with differences amongst participants and fewer participants are needed because each participant is involved with all three conditions (Charness et al., 2012). The disadvantage is that there is an increased risk for a carryover effect between the three conditions. In other words, the performance in one condition may affect the performance in the next condition (Charness et al., 2012). This effect was accounted for by systematically varying the assignment of narratives to the different conditions, and varying the order of condition presentation across participants, to reduce the possibility of order and carryover effects (Dada et al., 2019; Wallace et al., 2012). The participants were also grouped by varying severity to reduce the risk that the more severe participants all received less support by chance, as illustrated in Table 2.

Table 2

Assignment of narratives to conditions and order of condition presentation

Participants	Condition	Narrative
4, 6	0%	1
	50%	2
	100%	3
1, 5, 7	100%	3
	0%	1
	50%	2
	50%	2
2, 3	100%	3
	0%	1

Research Phases

The research is comprised of two phases as outlined in Table 3, namely Phase I – the development phase and Phase II – the main study. The purpose of the development phase was to: (a) adapt and develop appropriate materials and measuring instruments to be used in the study; (b) assess the feasibility of the research in terms of measurements, procedures and data analysis; and (c) recruit participants. The main study involved collecting and analyzing data from the participants.

Table 3

Research phases

RESEARCH PHASES		
Phase I: Development phase		
1.1 Adaptation and development of materials	*1.2 Pilot study*	*1.3 Participant recruitment and selection*
Permission was obtained from Prof. Sarah Wallace to make use of the materials from the study conducted by Wallace et al. (2012). These materials were then suitably adapted for the current study.	The pilot study aimed to assess the feasibility of the study in terms of recruitment strategy, participant selection criteria, pre-experimental tasks, data collection procedures and data capturing procedures, as well as duration of the experimental task.	During this phase potential participants were recruited.
Phase II: Main study		
2.1 Pre-experimental tasks	*2.2 Experimental tasks*	*2.3 Data analysis*
Participants were met at their home and the following were completed: Consent letters, biographical questionnaire, WAB-R, visual perceptual skills screening test and Written-choice Communication Strategy screening test.	After the pre-experimental tasks, the participants who met the necessary inclusion completed the experimental tasks. Comprehension items were used to capture the data.	Data were analyzed using descriptive and inferential statistics.

Materials and Equipment

Equipment. A video recorder (Samsung HMX-F900 video recorder) was used to capture all the experimental sessions.

Materials.

Permission letter from the Research Ethics Committee. Firstly, permission was obtained from the Research Ethics Committee of the University of Pretoria (Appendix A) in order for data collection to commence.

Permission letter from the Free State Department of Health. Permission was obtained from the Free State Department of Health (Appendix B) by means of an online application on the National Health Research Database.

Permission letter to managers of hospitals and clinics. After permission had been obtained from the Department of Health, a permission letter (Appendix C) was given to the managers of governmental hospitals and clinics in the Motheo and Thabo Mafutsanyana Districts to obtain permission to recruit patients from their facilities. The permission letter contained information pertaining to what the study entails, the purpose of the study, the selection criteria of participants and the requirements from the hospitals or clinics.

Permission letter to private practice owners. A letter (Appendix D) was given to private practice owners to obtain permission to recruit participants from their practices. The permission letter contained information pertaining to what the study entails, the purpose of the study, the selection criteria of participants and the requirements from the private practice owners.

Permission letter to Non-Governmental Organization. A letter (Appendix E) was given to the non-governmental organization (NGO) manager to obtain permission to conduct the research in their facility. The permission letter contained information pertaining to what the

study entails, the purpose of the study, the selection criteria of participants and the requirements from the NGO.

Pre-experimental tasks.

Letter of consent from persons with Wernicke's aphasia. Consent was obtained from the persons with Wernicke's aphasia. The letter was written in simple English and included visual aids to enhance understanding (Appendix F). The researcher or caregiver assisted the participants with the reading, comprehension and completion of the letter of consent. Participants were informed that participation in the study was voluntary and that they had the right to withdraw at any time without any consequence. Participants and their significant others were informed that they would be video recorded during the experimental task, and that all data would be stored at the University of Pretoria for 15 years.

Letter of consent from significant others. Participants in the study have impaired comprehension; therefore, consent was also obtained from a significant other (Appendix G). Individuals with communication and comprehension difficulties are vulnerable, and therefore precautions to ensure informed consent needed to be taken. Consent was also needed from the significant other as they participated in the study by assisting the person with Wernicke's aphasia with completing the biographical questionnaire.

Biographical questionnaire. Biographical questionnaires (Appendix H) were provided. The significant other of the person with Wernicke's aphasia helped to complete the questionnaire. Information regarding age, gender, side of cerebrovascular accident (CVA), handedness prior to CVA, date of onset, educational level and previous employment was obtained through the biographical questionnaire. The biographical questionnaire also had the participant number and the aphasia quotient (AQ) score.

Western Aphasia Battery – Revised (WAB-R). To determine the type and severity of language difficulties, the AQ section of the WAB-R (Kertesz, 2006) was completed (Appendix I). The WAB-R assesses the linguistic skills most frequently affected by aphasia. In the WAB-R, Wernicke's aphasia is classified by a score of less than 4 for fluency, less than 7 for auditory verbal comprehension, less than 8 for repetition and less than 10 for naming and word finding. The auditory verbal comprehension score is obtained by adding the scores of the comprehension subtests (yes/no questions, auditory word recognition and sequential commands), and then dividing the sum by 20 to arrive at a score out of 10.

Visual perceptual skills screening test. A cancellation task developed by the researcher that is similar to the one used in the studies by Wallace et al. (2012) and Dada et al.'s (2019) study, was used to assess visual perceptual skills. Participants were required to examine 10 names on a page and cross out a certain name each time they identified it (Appendix J).

Written-choice Communication Strategy screening test. Participants were required to answer four cloze-type statements aided by written one-word options. These options consisted of three foils and one correct answer (Appendix K). The researcher circled the answer to which the participant either pointed or named (Garrett & Beukelman, 1995).

Augmented input conditions for experimental task. For pre- and during-task stimulation, the participants were shown a high-context photograph (visual support) and the no-context PCS images with keywords (visual and linguistic support). During the 100% AI-PP condition, the researcher simultaneously read the narrative and pointed to the corresponding no-context PCS images, which represented 100% of the content units in each narrative. During the 50% AI-PP condition, the researcher simultaneously read the narrative and pointed to the corresponding no-context PCS images, which represented 50% of the content units in each narrative. During the

0% AI-PP condition, the researcher read the narrative without pointing to any corresponding no-context PCS images. The researcher removed the high-context image in all three conditions before reading out the comprehension items and clozed options.

Narratives. Three narratives, used in the Wallace et al. (2012) study, were used in this study (Appendix L). Each narrative contains five active voice sentences and two main characters (Wallace et al., 2012). Each story covers a problem and a solution. The narratives were balanced for number of words and level of difficulty (Wallace et al., 2012). Two of the narratives had already been adapted to be more culturally appropriate to the South African context (Dada et al., 2019). An expert panel review of Narrative 1 was conducted to also adapt it to the South African context. The experts were seven individuals with postgraduate degrees, and who work in the field of AAC. The experts were required to complete a questionnaire in which they judged the suitability of suggested changes to words in the narratives (Appendix M). The panel found the suggested changes to be suitable to the South African context, and the changes were therefore accepted.

Each narrative had a total of 75 words. The researcher and three postgraduate speech therapists autonomously read each narrative, and developed a list of content units or "words/phrases with meaning" which consisted mainly of nouns, verbs and adjectives (Dada et al., 2019). Of the 75 words in each narrative, 37 units (single words or phrases) from Narrative 2 and 37 units from Narrative 3 were identified as content units (Appendix N). These content units were used to develop the augmented input images.

Picture Communication Symbols™ (PCS) images. PCS images were used to supplement the narratives as AI-PP. Worldwide, PCS is the most commonly used aided graphic symbol set

(Beukelman & Mirenda, 2013); it is accessible and widely used in South Africa (Dada et al., 2019).

Narrative 1, *Lost Dog*, was the 0% condition, and therefore had no PCS supplementation. Narrative 2, *Out of Petrol*, was supplemented with PCS images at a frequency of 50% of the content units; in other words, 19 PCS images. Narrative 3, *Lost Purse*, was supplemented with PCS images at a frequency of 100% of the content units. Initially, this meant 37 PCS images. However, some of the images for specific content units were replaced with a combined image to represent more than one content unit, as these images were preferred by the pilot study participant and his significant other (Appendix O). For example, the researcher and three postgraduate speech therapists agreed on "little" and "girl" as two separate content units, while Dada et al. (2019) had a single image for "little girl". The pilot participant and his significant other were then shown separate images for "little" and "girl", and a combined image for "little girl". They indicated a preference for the combined image. For all eight of the other examples, they also preferred the combined option (Appendix O). This resulted in 28 PCS images representing the 37 content units in Narrative 3. The content units were then used as keyword support under each PCS image. Sixteen (16) colour images appeared on a page and each one measured 4 cm x 2,5 cm each (Appendix P).

High-context photographs. Three high-context photographs used in the Wallace et al. (2012) study were used as pre-task stimulation before the researcher read the narrative to the participant (Appendix Q). These photographs are associated with each narrative and are non-personalized in nature. These 11 cm x 15 cm photographs were in colour and appeared on a laminated sheet of paper.

Comprehension items. Fifteen (15) cloze-type statements and four response options associated with each narrative were used to assess participants' comprehension of the narrative (Appendix R). These items were also used in the study by Wallace et al. (2012). A passage dependency index was calculated for each narrative and associated comprehension items to ensure that the comprehension items truly measured comprehension related to the associated narrative (Wallace et al., 2012).

Procedural script. A procedural script was used during the three conditions to ensure that they were carried out as specified (Appendix S). The script of procedures included: a) the researcher showing the high-context photograph to the participant before reading the narrative, b) the researcher reading Narrative 1 twice with 0% AI-PP, Narrative 2 twice with 50% AI-PP and Narrative 3 twice with 100% AI-PP, c) the researcher removing the high-context images in all three conditions before reading out the comprehension items and cloze options, and d) the researcher following the outlined Written-choice Communication Strategy (Garrett & Beukelman, 1995) procedures for presentation of the comprehension items.

Feedback pamphlet. A pamphlet outlining the aims of the study, participants, methodology, findings and implications was made in the form of a Microsoft Publisher document (Appendix T). This was provided to the participants and their significant others, as well as to the speech therapy private practice owners, NGO and hospital managers, and the Free State Department of Health to disseminate the findings.

Pilot study.

Objectives. Pilot studies are designed to function as a "dummy run" to assess the feasibility of the research (Lancaster, Dodd, & Williamson, 2001). The pilot study therefore intends to put the required procedures in place for the main study. The aims of the pilot study

were to ensure that selection criteria were appropriate; to evaluate the clarity of the information and instructions of the pre-assessment and assessment tasks; to evaluate the appropriateness of the equipment and materials as well as the data collection forms and questionnaires; and to evaluate the effectiveness of the process of capturing and analyzing the data.

Participant. A private practitioner was contacted to informed them of the nature and purpose of the pilot study, and permission was obtained to recruit a participant from the practice (Appendix D). The possible participant and their significant other were contacted and a date and time to meet was arranged. The participant met similar selection criteria for the main study (Table 5); however, he differed with regard to the amount of time that had elapsed post-stroke. This concession was made to include all possible participants who met the inclusion criteria in the main study. The difference in selection criteria was not considered a threat as the pilot study's aim was to assess the processes, materials, duration and the management of data. The participant was a right-handed 49-year-old male who had had a left hemisphere stroke two months prior to the pilot study. He is divorced, has a diploma and his home language is Sesotho. His auditory comprehension score was 2,25 and his AQ was 10.

Aims, materials, procedures, results and recommendations. The aims, materials, procedures, results and recommendations of the pilot study are summarized in Table 4.

Table 4

Pilot study: Aims, materials, procedures, results and recommendations

Aims	Materials	Procedures	Results	Recommendations
1. To assess the feasibility of the recruitment process.	Letters of information and permission slips	Letters of information and permission slips were emailed to (a) hospital managers, (b) private practice owners and (c) NGOs.	Limited response to e-mails	Personal contact should be made, either via a phone call or a visit to the hospital, private practice or NGO / stroke-support group.
2. To assess the feasibility of the participant selection criteria in terms of: i) Wernicke's aphasia secondary to a left CVA at least 6 months prior; ii) no history of language or cognitive disability prior to CVA; iii) normal or corrected vision and hearing; iv) proficiency in English; and v) ability to use Written-choice Communication	a) Biographical questionnaire b) WAB-R c) Visual perceptual skills screening test d) Written-choice Communication Strategy screening test	Determined by means of the pre-experimental tasks.	i) Participant had global aphasia secondary to a left CVA only 2 months prior; ii) Participant had no history of language or cognitive disability prior to CVA; iii) Participant had normal vision and hearing. Passed the visual perceptual screening test; iv) Participant and their significant other reported to be proficient in English; however, the significant other continued to translate into the participant's home language; v) Participant passed 3 out of the 4 Written-choice Communication Strategy questions, which result in 75% accuracy.	i) Concession was made for this change in inclusion criteria in the pilot study to not take away possible participants from the main study. iv) Information letters to partners and the instructions given during the sessions with the participants and their significant others need to be made clearer regarding the study being conducted in English only. v) Change the inclusion criteria from 80% accuracy in the Written-choice Communication Strategy to 75%, as options can only be 0, 25, 50, 75 or 100% accuracy when given only 4 questions.

Aims	Materials	Procedures	Results	Recommendations
Strategy with 80% accuracy.				
3. To assess whether the information letters for the person with Wernicke's aphasia and their significant other was appropriate and easy to understand.	Information and consent letters for person with Wernicke's aphasia and their significant other	The participant and their significant other were asked if the information was appropriate and easy to understand.	The participant and their significant other reported that the language was clear and that the images helped them to understand the information letter better.	No changes recommended.
4. To assess the ease of administration of the pre-experimental tasks and the experimental tasks, as well as the duration thereof.	a) Biographical questionnaire b) WAB-R c) Visual perceptual screening test d) Written-choice Communication Strategy e) 3 high-context photographs f) 2 sets of PCS images g) Comprehension items	The participant and their significant other were asked about how they found the pre-experimental tasks and the experimental tasks in terms of ease, clarity and duration. The researcher timed the pre-experimental tasks, as well as the experimental tasks.	The participant and their significant other found the instructions during the pre-experimental and the experimental tasks to be clear and easy to understand. However, the significant other continued to translate into the participant's home language during the experimental task to help them answer more correctly. The participant and their significant other reported that the duration of the pre-experimental and the experimental task was acceptable. The participant did not report fatigue. A 10-minute break between pre-experimental tasks and experimental tasks was sufficient. The participant chose not to make use of break times in-between the three narratives.	The significant other will be excluded from the experimental tasks to ensure that they do not prompt the responses. No other changes recommended.

Aims	Materials	Procedures	Results	Recommendations
			The pre-experimental tasks took approximately 40 minutes (the patient was unable to vocalize, so other PWA might take longer). The experimental tasks took approximately 40 minutes.	
5. To assess the appropriateness of the high-context photographs and the no-context PCS images.	3 high-context photographs and 2 sets of PCS images	The participant and their significant other were asked about how appropriate they found the photographs and PCS images. They were also asked regarding their preference of different PCS images that best represented an intended meaning.	The participant and their significant other found the high-context images to be appropriate. Both the participant and their significant other preferred the combined image for some content units, instead of a separate image for each content unit (Appendix O).	No changes were recommended to the high-context images. Replace the separate images for specific content units, with a combined phrase image (Appendix O).
6. To evaluate the appropriateness of the vocabulary of the narratives and the comprehension items.	3 narratives and 3 sets of 15 cloze-type statements	The participant and their significant other were asked about how appropriate they found each narrative and its comprehension items	The participant and their significant other agreed with the expert panel on the change of words in Narrative 3. They suggested changing “witnessed” to “saw” in Narrative 1’s comprehension question number 13, as it is easier to understand.	Some of the vocabulary in the narratives and comprehension items was changed to be more appropriate for the South African context. The word “country” was changed to “rural area”, the word “gas” was changed to “petrol” and

Aims	Materials	Procedures	Results	Recommendations
		in terms of vocabulary and content.		the word “pickup truck” was changed to “bakkie”. A change was recommended in Narrative 1’s comprehension question 13, where the word “saw” was replaced with the word “witnessed”.
7. To assess the appropriateness of the procedural script used to maintain treatment integrity during the experimental task.	Procedural script	The researcher followed the procedural script to guide the pre-experimental and experimental tasks, and ticked off each step during the process.	The researcher found the script to be clear and easy to follow.	No changes were recommended.
8. To ensure that the recording device aids the procedural integrity of the data collection.	Samsung Galaxy TabA	The participant and researcher were video recorded during the experimental condition.	Although a trial was run with the recording device beforehand, the device automatically stopped recording after 15 minutes and had to be restarted – this broke the flow of the experimental task. The correct angle was also difficult to manage with the TabA as the researcher was in the participant’s home and did not have control over the surroundings (for example, setting up tables / a place to put the recording device).	The Samsung Galaxy TabA was used as a backup, but the main recording device was switched to a Samsung HMX-F900 video recorder. This device comes with a tripod, which makes it easier to record the correct angle no matter the surroundings. This device is also a dedicated video recording device with excellent video and sound and no automatic stopping mechanism.

Summary of pilot study. The pilot study highlighted the areas that would need amendments for the main study. This encompassed clearer instructions given to the participant and their significant other regarding the use of only English during the conduction of the study. Significant others wanted participants to succeed during the comprehension tasks, so they would repeat items or translate into the participant's home language. In the main study, significant others were asked, after the consent letters had been signed and biographical questionnaires were completed, to not participate any further. Furthermore, the inclusion criteria of 80% accuracy in the Written-choice Communication Strategy screening test was changed to 75%, as that is a viable accuracy option when given only four questions.

Some of the images for specific content units were replaced with a combined image to represent more than one content unit, as these images were preferred by the participant and their significant other (Appendix O). Some of the vocabulary in Narrative 2 and in comprehension items was changed to be more appropriate for the South African context. The word "country" was changed to "rural area", the word "gas" was changed to "petrol", and the word "pickup truck" was changed to "bakkie". The word "witnessed" was also replaced by the word "saw" in comprehension question 13 of Narrative 1, as this was deemed an easier word to understand. Lastly, amendments were made with regard to the recording device. A dedicated video recorder with a tripod stand, the Samsung HMX-F900, was decided on for the main study in the place of the TabA.

Main Study

Sampling and recruitment. Purposive sampling was used to recruit participants as they were selected based on specific pre-determined selection criteria (Etikan, Musa, & Alkassim, 2016). This type of sampling is beneficial for a small sample pool, but a limitation of this

sampling is the non-random selection of participants as the researcher is biased in choosing the subjects of the study due to the pre-determined selection criteria (Etikan et al., 2016). Seven participants who met the inclusion criteria, as described in Table 5, were recruited.

Participants were recruited by three different methods, namely (i) contacting governmental hospitals and clinics; (ii) contacting private speech therapists; and (iii) contacting NGOs offering stroke-support groups or post-stroke care.

The owners of the private practices, the chairpersons of the NGOs and the managers of the hospitals and clinics were contacted either in person, telephonically or via email, and were asked whether they would be willing to assist with the recruitment of participants. A letter containing all the information relating to the study and the selection criteria of potential participants was included in the initial visit or email.

The researcher visited two governmental hospitals and one governmental clinic in the Free State area, and telephonically contacted a further two hospitals. Two hospitals gave permission to assist with the recruitment of participants. Individuals who met the selection criteria were then contacted and asked to participate in the study. Two potential participants were recruited from these sites.

The researcher telephonically contacted ten owners of private practices in the Free State area and informed them of the nature and purpose of the research study. The participant selection criteria and information letter were emailed to the owners, who gave permission to assist with the recruiting of participants. The private practice owners were asked to check their past and present client records for any potential participants. One private practice owner gave consent and had two clients who met the inclusion criteria. The individuals who met the selection criteria were

contacted and asked to participate in the study. Two potential participants were recruited from this site.

Fourteen (14) NGOs were contacted, and permission to assist with recruitment was obtained from six NGOs. The researcher attended one of the support group meetings to inform members about the nature and purpose of the study and called on any interested individuals who met the inclusion criteria to participate in the study. The other NGOs were personally visited and information relating to the study and the selection criteria of potential participants was discussed with the chairpersons. A total of 17 potential participants were identified from these sites.

A list of all the potential participants (21 persons) from the different sites was drawn up. The researcher telephoned all the candidates or their significant others to verbally inform and invite them to participate in the research. Nineteen (19) potential participants agreed to participate, and a date and time was arranged to meet. Of these 19, only 7 participants met the selection criteria. Two (2) participants were excluded, as they did not meet the criteria of being proficient in English and another 2 were excluded for not being able to answer the Written-choice Communication Strategy screening test questions with 75% accuracy. Eight (8) participants were excluded as they did not meet the criteria of having Wernicke's aphasia as tested on the WAB-R (Kertesz, 2006).

Selection criteria. The participant selection criteria are presented in Table 5.

Table 5

Participant Selection Criteria

Criterion	Justification	Measure used
Aphasia secondary to a left CVA	Aphasia can be secondary to various types of brain injuries; however, it is mostly due to a left CVA (Garret & Lasker, 2005). Features of the PWA secondary to CVA may differ slightly from those other than CVA.	As determined by information provided in the biographical questionnaire.
Classification of Wernicke's aphasia	Wernicke's aphasia is characterized by severely impaired auditory comprehension (Robson et al., 2013, 2014; Robson, Sage, et al., 2012) and numerous researchers have noted communicative success during interactions with PWA when they are provided with visuographic supports (Beukelman et al., 2015; Garrett & Huth, 2002; Ho, Weiss, Garrett, & Lloyd, 2005).	As determined by the criteria classification scores of the AQ section of the Western Aphasia Battery – Revised (WAB-R) (Kertesz, 2006).
Minimum of 6 months post-CVA	To ensure stability of performance, participants' recovery should be stabilized (Cherney & Robey, 2008).	As determined by information provided in the biographical questionnaire.
Proficient in English	To ensure maximum comprehension of narratives and questions, participants were required to have been proficient in English prior to onset of aphasia.	As established via self-report from participant and caregiver.
No history of language or cognitive disability prior to CVA	As aphasia is a language impairment that is acquired after brain injury, pre-morbid language impairments may skew the results (Lasker & Garrett, 2006).	As determined by information provided in the biographical questionnaire.
Has a significant other (family member or friend)	As PWA may have impaired comprehension (Wallace et al., 2012), information may need to be gathered from the participants' significant others. Informed consent is also needed from both the participants and their significant others, due to the	As established via self-report from participant and caregiver when appointment was made.

Criterion	Justification	Measure used
	participants' possible vulnerability. Their significant other must be present to witness the PWA give their consent.	
Normal or corrected hearing and vision	This study measures auditory comprehension as well as visual and linguistic augmented input, and therefore participants need to be able to hear and see.	As determined by information provided in the biographical questionnaire, and performance during the visual perceptual skills screening test and Written-choice Communication Strategy screening test.
Ability to answer questions using Written-choice Communication Strategy with 75% accuracy	This is the method that will be used to answer the questions in the experimental task as the comprehension of written words is significantly less impaired in persons with Wernicke's aphasia than their auditory modalities (Robson, Sage, et al., 2012; Thompson et al., 2015).	As determined by performance on Written-choice Communication Strategy screening test.

Descriptive criteria. Participants comprised 7 persons with Wernicke's aphasia. Their ages ranged from 60 to 84 years old (M = 63.92). The participants consisted of 4 males and 3 females. All participants had aphasia secondary to a left CVA and were at least 6 months post-stroke. The number of months post-stroke ranged from 9 to 113 months (M = 49.14). Two (2) participants were English first language speakers and 5 were Afrikaans first language speakers. Two (2) participants had matric, 2 participants had a diploma, 2 participants had undergraduate degrees and 1 participant had a postgraduate degree. Three (3) participants were married, 1 participant was single, 1 participant was divorced and 2 participants were widowed. Five (5) participants had been right-hand dominant prior to the stroke and two participants had been left-hand dominant. All the participants made use of mobility aids such as walking sticks and wheelchairs and 2 participants had problems with their vision and wore spectacles. No participants had experienced any difficulty with their hearing or had a history of language or cognitive impairments prior to the stroke.

A total of 5 participants reported difficulties in memory following their stroke. Three (3) participants received speech therapy services following their stroke. Two (2) of those participants received in-hospital acute speech therapy only, mainly for speech difficulties. The other participant was receiving weekly speech therapy focusing on language and memory skills. None of the participants had been exposed to AAC or picture communication in speech therapy.

The scores for the auditory verbal comprehension subtest on the WAB-R (Kertesz, 2006) ranged from 5.4–6.9 (M = 6.27), and the AQ ranged from 27–81.2 (M = 63.49). Participant descriptions were obtained from the biographical questionnaire and pre-experimental tasks and are presented in Table 6 below.

Table 6

Participant descriptions

Participant number	Age (in years)	Gender	Marital status	Education level	First language	Additional language proficiency	Time post-CVA (in months)	Auditory comprehension score	WAB-R aphasia quotient (AQ)	WAB-R AQ Severity Rating
1	69	F	Single	Diploma	Afrikaans	English	84	6.9	81.2	Mild
2	71	M	Married	Postgraduate Degree	Afrikaans	English	9	6.4	63.4	Moderate
3	76	M	Married	Degree	Afrikaans	English	113	5.8	58.2	Moderate
4	84	M	Widow	Matric	English	Afrikaans	13	5.8	70.8	Moderate
5	78	F	Widower	Degree	English	Afrikaans	72	5.4	27	Severe
6	72	M	Married	Diploma	Afrikaans	English	37	6.85	72.1	Moderate
7	71	F	Divorced	Matric	Afrikaans	English	16	6.75	71.7	Moderate

Procedures

Ethical Considerations. When it comes to research conducted with human participants, there are certain ethical principles to consider. Two principles for biomedical ethics mentioned by Beauchamp and Childress (2009) are respect for autonomy and beneficence. These principles were adhered to in this study.

First, respect for autonomy includes telling the truth about the research aims, respecting the participants' privacy and confidential information collected during the research project, and obtaining informed consent before conducting the research (Beauchamp & Childress, 2009). All data collected will remain confidential to the researcher and thus no participant will be identifiable in the final report or any succeeding publications or presentations. Furthermore, all participants were informed regarding the purpose of the study and their role therein. Informed consent was obtained from both the participants and their significant others, due to the participants' possible vulnerability. This included writing the information in simple English and providing visual aids to enhance understanding. Their significant other was present to witness the person with Wernicke's aphasia give their consent (Dada et al., 2019).

Second, beneficence refers to the duty of the researcher to minimize any risk to the participant and maximize the benefit to the participant and/or the population (Beauchamp & Childress, 2009). The researcher attempted to avoid any possible negative consequence by negotiating a time that was suitable to the participant and/or caregiver so that no therapy, for example, is missed. The meetings also took place in an environment that was familiar to the participants and their significant others so that there was no discomfort or financial strain involved with travelling.

General Procedures. After the Research Ethics Committee of the Faculty of Humanities, University of Pretoria, had given their approval, and written permission for participants to be recruited had been received from (a) Free State Department of Health, (b) private speech therapy practices and (c) NGOs, participants who met the selection criteria were contacted and asked if they were willing to take part in the study. A date and time for a meeting was agreed upon. This concluded the development phase, as illustrated in Table 3.

The researcher individually met those persons with Wernicke's aphasia (the participants) and their significant others who had verbally given their consent to participate in the research study, in their homes. After an introduction, the researcher explained the procedures in the study and then consent forms were provided to the participants and their significant others. Since the participant may have reduced comprehension, written consent was obtained from both the participant and their significant other.

Data Collection Procedures. The pre-experimental tasks began as soon as the consent letters had been signed by both the significant others and the participants. The participant and the significant other first completed the biographical questionnaire. The visual perceptual skills screening test, the Written-Choice Communication Strategy screening test (Garrett & Beukelman, 1995) and the AQ section of the WAB-R (Kertesz, 2006) were then completed. The participants who did not meet the inclusion criteria were thanked for their time, given a small token of appreciation and excluded from the study. The participants who met the inclusion criteria were offered a comfort break of 15 minutes (Dada et al., 2019) before continuing with the experimental task.

The experimental task was video recorded. The order of conditions presented were varied across participants to reduce the possibility of order and carryover effects. As illustrated in

Table 2, participants 4 and 6 were in Group 1 (0%, 50% and 100% order), participants 1, 5 and 7 were in Group 2 (50%, 100% and 0% order) and participants 2 and 3 were in Group 3 (100%, 0% and 50% order).

For pre-task stimulation, the participants were shown a high-context photograph and the no-context PCS images. Participants were informed that the images provided some information regarding the narrative that would follow. The pre-task stimulation lasted one minute (Dada et al., 2019) and then a narrative was read to each participant twice at a similar rate. Both the high- and no-context PCS images remained in front of the participant during the reading of the narrative as during-task stimulation in all three conditions. During the 100% AI-PP condition, the researcher simultaneously read the narrative and pointed to the corresponding no-context PCS images, which represented 100% of the content units in each narrative. During the 50% AI-PP condition, the researcher simultaneously read the narrative and pointed to the corresponding no-context PCS images, which represented 50% of the content units in each narrative. During the 0% AI-PP condition, the researcher read the narrative without showing or pointing to any corresponding no-context PCS images. The researcher removed the high-context image in all three conditions before reading out the comprehension items and clozed options.

The comprehension items were introduced after the reading of the narrative. Each comprehension item was read aloud twice by the researcher, who simultaneously pointed to each of the response options. The participant then specified their response by either pointing to the desired option or verbally saying it aloud. The participants were given two minutes to respond to each question (Dietz et al., 2009). Feedback was provided according to the procedural script (Appendix S) to help reassure and motivate the participants at regular intervals.

Before moving on to the next item, the researcher repeated the participant's choice, and circled it. The comprehension items and no-context PCS images were removed from the table after all 15 of the comprehension items related to Narrative 1 had been completed, and the participants were offered another comfort break of 10 minutes before Narrative 2 commenced. Identical procedures to those outlined above were followed during the reading of the second and third narrative, except the condition (0%, 50% or 100% AI-PP) and the narrative (1, 2 and 3) were altered for each participant. After the experimental task, participants were given a small token of appreciation.

Data analysis. Descriptive statistics were calculated from the biographical data and WAB-R (Kertesz, 2006) scores were captured on a Microsoft Excel© spreadsheet. A Microsoft Excel© spreadsheet was made for data collected from the comprehension items, and the scores for each participant in each condition were compared and described. Descriptive statistics were calculated for the responses to comprehension items across the three conditions (0%, 50% and 100% AI-PP) and presented in tables and bar charts. The independent variable was the conditions and the dependent variable was the accuracy of responses. As it is a repeated measure study and the data are parametric with comparisons being made between the three conditions, a mixed model analysis of variance (ANOVA) was used (Ertheiss, 2014). Two-way ANOVA was conducted to determine if there were any carryover effects. Comparisons were also made between the participants' auditory verbal comprehension score on the WAB-R (Kertesz, 2006) and the number of accurate responses to comprehension items across the three conditions. The advantages of using an ANOVA are that it is a very simple method to test differences between two or more means and it can reduce the experimental error to a great extent. On the other hand, it may not be as efficient and sensitive as compared to other methods (Ertheiss, 2014).

Reliability and validity.

Procedural Integrity. To decrease the risk for inconsistencies in procedures across participants, the researcher followed a procedural script when conducting the experimental task (Schlosser, 2002). Furthermore, the experimental task was video recorded, and an inter-rater, a chartered accountant, viewed a randomly selected 40% of the video recordings (Schlosser, 2002). The inter-rater assessed the treatment integrity in the three conditions using the procedural script to determine procedural integrity by means of a percentage agreement (McMillian & Schumacher, 2014). This procedural integrity percentage was calculated using the following formula:

$$\frac{Number\ of\ correct\ steps}{Total\ number\ of\ steps}\ X100 = Procedural\ Integrity\ Percentage$$

$$\frac{104}{108}\ X100 = 96.30\%$$

Procedural integrity was high at 98.5%, indicating excellent procedural consistency (McMillan & Schumacher, 2010). Procedural integrity was further ensured by having a single examiner (the researcher) present the narratives and questions to the participants. This decreased the risk that factors such as rate and intonation had an effect on the narrative comprehension (Wallace et al., 2012).

Data Collection Reliability. Data from the biographical questionnaire, WAB-R (Kertesz, 2006) and comprehension items were captured on a Microsoft Excel© spreadsheet. The inter-rater was asked to independently correlate a randomly selected 30% of the raw data and the data on the Microsoft Excel© spreadsheet. Percentage agreement was calculated to determine if the

data had been recorded correctly (McMillian & Schumacher, 2014). This percentage was calculated using the following formula:

$$\frac{Number\ of\ agreements}{Number\ of\ agreemens + disagreements}\ X100 = Percentage\ agreement$$

$$\frac{90}{90 + 0}\ X100 = 100\%$$

Percentage agreement was 100%, which is considered excellent (McMillan & Schumacher, 2014).

Validity. As the study used a repeated measures design, there may be a carryover effect between conditions, resulting in a threat to the internal validity of the study. The carryover and order effects were accounted for by systematically varying the order of condition presentation across participants to reduce the possibility of order and carryover effects (Dada et al., 2019; Wallace et al., 2012). Furthermore, the external construct validity was increased in this study by utilizing resources designed and applied by previous published studies (Dada et al., 2019; Wallace et al., 2012).

Further threats to internal validity were controlled for by using only one researcher who followed a script to reduce inconsistencies during data collection. Uncontrolled events such as the researcher acting slightly different on some days or the diverse environments influencing the variables measured were more difficult to control and therefore need to be acknowledged.

Results

The results of the study are discussed according to the four sub-aims, namely (i) the accuracy of responses during the 0% AI-PP condition; (ii) the accuracy of responses during the 50% AI-PP condition; (iii) the accuracy of responses during the 100% AI-PP condition; and (iv) comparisons between these conditions. In addition, individual analysis of (v) participants' auditory comprehension difficulties, as determined by their scores on the auditory verbal comprehension subtest of the WAB-R (Kertesz, 2006) and response accuracy; and (vi) response accuracy for each comprehension item for each of the narratives are described.

Accuracy of Responses During the 0% AI-PP Condition

In the 0% AI-PP condition, participants obtained an average accuracy score of 54,29%. The accuracy scores during the 0% AI-PP condition ranged from 5–13 (M = 8.14 and SD = 2.48). Participants 3, 4, 5, 6 and 7 (n = 5) had accuracy scores below the mean during the 0% AI-PP condition, while participants 1 and 2 (n = 2) had accuracy scores above the mean (Figure 2). The five participants that scored below the mean had an AQ severity rating of moderate aphasia, except for Participant 5 whose rating is severe. The two participants who scored above the mean had an AQ severity rating of mild and moderate respectively. Participant 2 had the highest accuracy score during the 0% AI-PP condition, while Participant 6 had the lowest accuracy score. Both these participants had an AQ severity rating of moderate, with Participant 2 having a lower auditory comprehension score than Participant 6 on the WAB-R subtest (Kertesz, 2006).

Accuracy of Responses During the 50% AI-PP Condition

In the 50% AI-PP condition, participants obtained an average accuracy score of 61,9%. The accuracy scores during the 50% AI-PP condition ranged from 5–14 (M = 9.29 and SD = 2.93). Participants 3, 5 and 6 (n = 3) had accuracy scores below the mean during the 50%

AI-PP condition, while participants 1, 2, 4 and 7 (n = 4) had accuracy scores above the mean (Figure 2). The three participants that scored below the mean had an AQ severity rating of moderate aphasia, except for Participant 5 whose rating was severe. The four participants who scored above the mean had an AQ severity rating of moderate, except for Participant 1, whose rating was mild. Participant 2 had the highest accuracy score during the 50% AI-PP condition, while Participant 5 had the lowest accuracy score. Participant 2 had an AQ severity rating of moderate and Participant 5's rating was severe (Kertesz, 2006).

Accuracy of Responses During the 100% AI-PP Condition

In the 100% AI-PP condition, participants obtained an average accuracy score of 47,62%. The accuracy scores during the 100% AI-PP condition ranged from 5–13 (M = 7.14 and SD = 3.80). Participants 3, 4, 6 and 7 (n = 4) had accuracy scores below the mean during the 100% AI-PP condition, while participants 1, 2 and 5 (n = 3) had accuracy scores above the mean (Figure 2). The four participants that scored below the mean had an AQ severity rating of moderate aphasia, while those that scored above ranged from severe to mild aphasia (one with severe, one with moderate and one with mild). Participant 2 had the highest accuracy score during the 100% AI-PP condition; while participants 3, 6 and 7 (n=3) had the lowest accuracy score. All four these participants had an AQ severity rating of moderate; however, Participant 6 had the highest auditory verbal comprehension score on the subtest of WAB-R, followed closely by Participant 7, then by Participant 2 and lastly Participant 3 with the lowest score (Kertesz, 2006).

Comparison Across the Three Conditions

The accuracy of responses to auditory comprehension tasks across the three conditions (0%, 50% and 100%) was compared and analyzed. Participants received an average accuracy

score of 54.6% across the three conditions (*M* = 8,19; *SD* = 3,09). Figure 2 shows the individual participation performance across the three conditions.

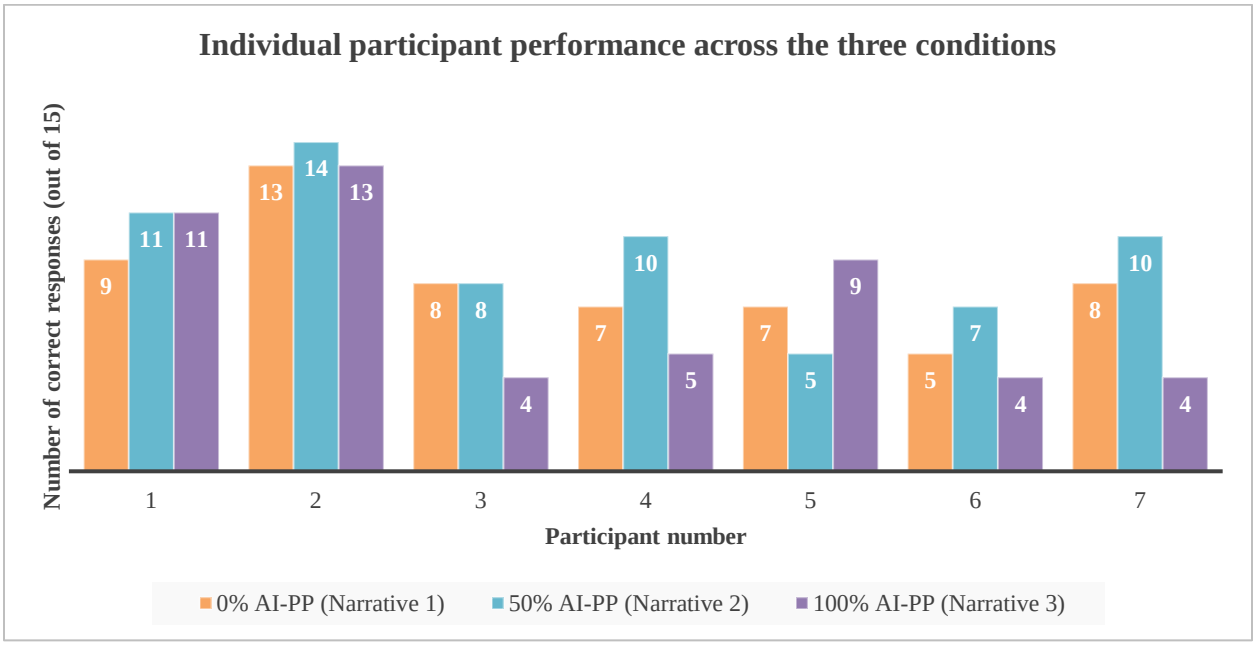

Figure 2. Individual participant performance across the three conditions

One participant (Participant 5) scored higher in the 100% AI-PP condition than in the other two conditions, while one participant (Participant 1) received the same scores in the 100% and 50% conditions and one participant (Participant 2) received the same scores in the 100% and 0% conditions. A total of four participants (participants 2, 4, 6 and 7) scored higher in the 50% AI-PP condition than in the other two conditions, while one participant received the same scores in the 100% and 50% conditions (Participant 1) and one participant received the same scores in the 50% and 0% conditions (Participant 3).

Statistical comparison across the three conditions. A mixed model ANOVA using the LSD procedure (p = .05) was conducted to compare the effect of the varying frequencies of AI-

PP on the auditory comprehension of people with Wernicke's aphasia. This model could be used as the assumption of normality had been met. The ANOVA was used to determine whether there was any carryover effect from the order of presentation of conditions. The results of $F(2,4) = 0.87$, $p = 0.49$ indicated that there were no carryover effects between the order of conditions presented.

There was no statistically significant difference between the average accuracy scores when looking at all three conditions, with $F(2, 12) = 2.30$, $p = 0.14$ (Figure 3). When looking at the relationship between two conditions, there was also no significant difference between the average accuracy scores of the 0% and 50% AI-PP conditions ($p = 0.27$), or between the average accuracy scores of the 0% and 100% AI-PP conditions ($p = 0.34$). However, when looking at the relationship between the average accuracy scores of the 50% and 100% AI-PP conditions alone, the p-value is 0.05, indicating that the participants did significantly better in the 50% than in the 100% condition. As the study has a small sample size, Hedges's g formula was used to determine the effect size between the conditions. The difference between the 0% and 50% and the 0% and 100% AI-PP conditions were both determined as small (0.39 and 0.29 respectively). However, the effect size was shown to be medium (0.59) when looking at the difference between the 50% and 100% AI-PP conditions. Figure 3 graphically depicts the average for each of the three conditions.

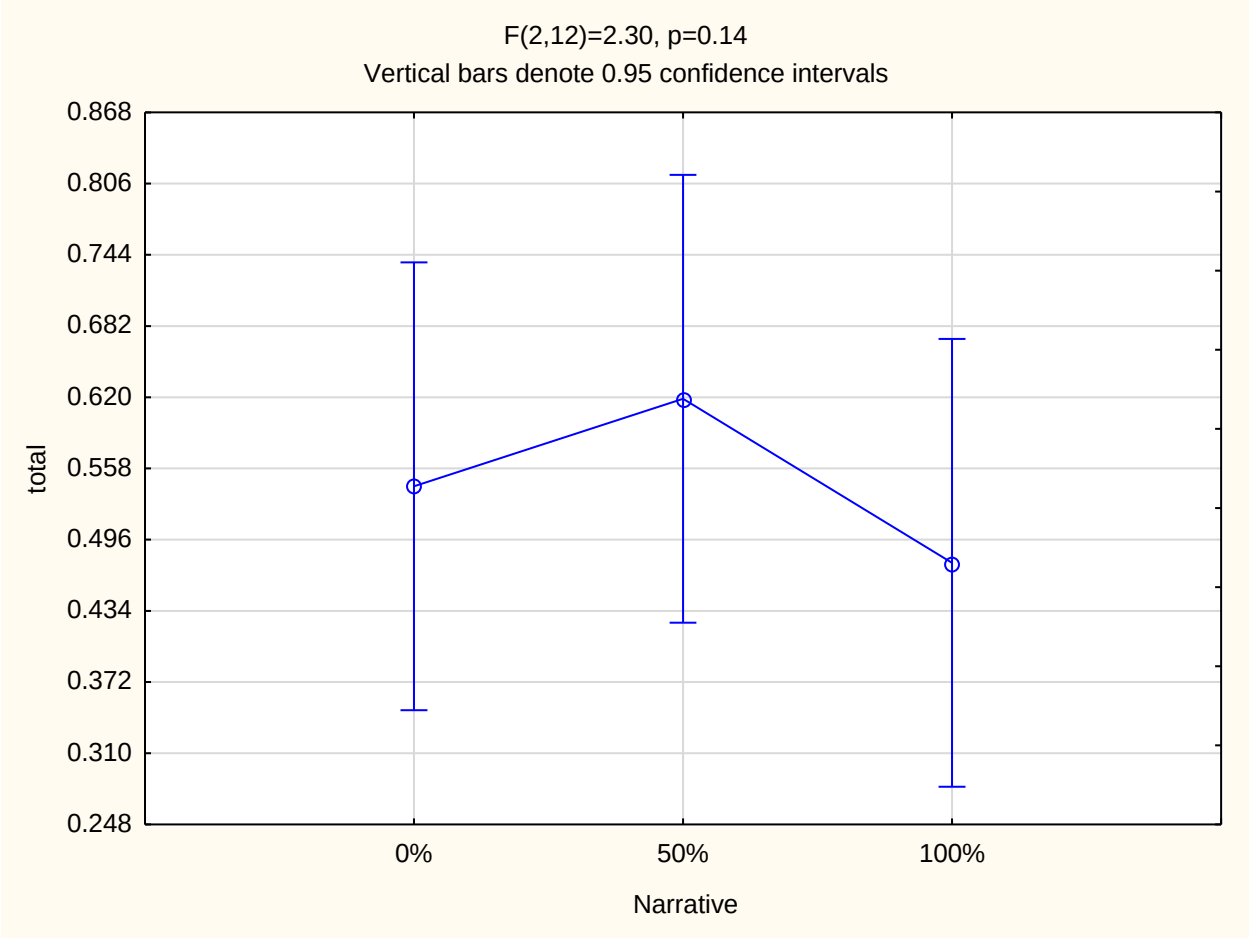

Figure 3. Average accuracy scores across the three conditions

Analysis of Individual Comprehension Items

The comprehension items of each narrative were analyzed to determine the percentage of correct and incorrect responses from each of the participants. During the comprehension items related to the 0% AI-PP condition (Narrative 1), most participants answered 9 comprehension items correctly and 6 items incorrectly (Figure 4). This corresponded to items 1, 2, 4, 5, 9, 10, 12, 13 and 14 which were answered correctly by the majority of participants, while the majority of participants responded inaccurately to items 3, 6, 7, 8, 11 and 15. Comprehension items 1, 2, 6, 9, 10, 11, 12, 13, 14 and 15 (n = 10) were considered factual questions, while comprehension

items 3, 4, 5, 7 and 8 (n = 5) were considered inferential questions. Most participants responded accurately to 70% of the factual comprehension items, while the majority of participants responded accurately to 40% of the inferential items.

The percentage of correct and incorrect responses for the 0% AI-PP condition (Narrative 1) is represented in Figure 4.

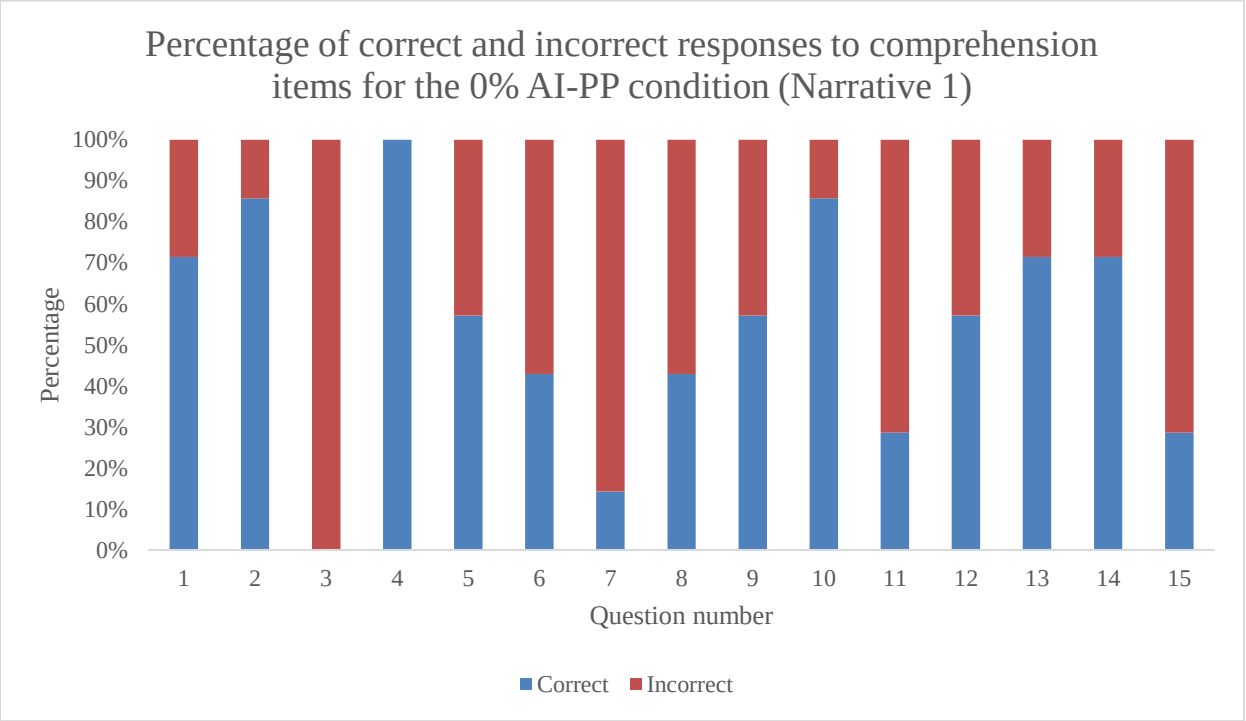

Figure 4. Percentage of correct and incorrect responses to comprehension items for the 0% AI-PP condition (Narrative 1)

During the comprehension items related to the 50% AI-PP condition (Narrative 2), most participants answered 10 comprehension items correctly and 5 items incorrectly (Figure 5). This corresponded to items 1, 2, 4, 6, 8, 10, 11, 13, 14 and 15 which were answered correctly by the majority of participants, while the majority of participants responded inaccurately to items 3, 5,

7, 9 and 12. Comprehension items 1, 2, 3, 5, 6, 7, 12, 13, 14 and 15 (n = 10) were considered factual questions, while comprehension items 4, 8, 9, 10 and 11 (n = 5) were considered inferential questions. Most participants responded accurately to 60% of the factual comprehension items, while most participants responded accurately to 80% of the inferential items. The percentage of correct and incorrect responses in the 50% AI-PP condition (Narrative 2) is represented in Figure 5.

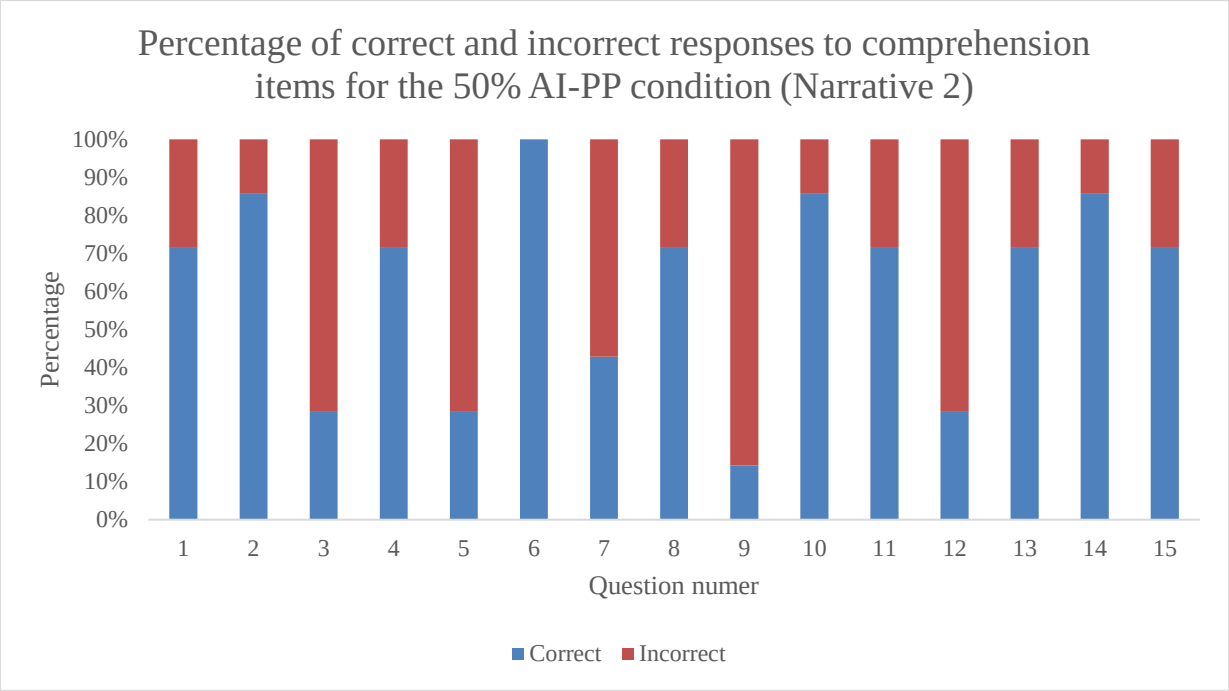

Figure 5. Percentage of correct and incorrect responses to comprehension items for Narrative 2 (50% AI-PP)

During the comprehension items related to the 100% AI-PP condition (Narrative 3), most participants answered 7 comprehension items correctly and 8 items incorrectly (Figure 6). This corresponded to items 1, 2, 3, 4, 6, 9 and 15 which were answered correctly by the majority of participants, while the majority of participants responded inaccurately to items 5, 7, 8, 10, 11, 12,

13 and 14. Comprehension items 1, 2, 3, 4, 6, 7, 9, 12, 13 and 15 (n = 10) were considered factual questions, while comprehension items 5, 8 10, 11 and 14 (n = 5) were considered inferential questions. Most participants responded accurately to 70% of the factual comprehension items, while most participants did not respond accurately to any of the inferential items. The percentage of correct and incorrect responses to the 100% AI-PP condition (Narrative 3) is represented in Figure 6.

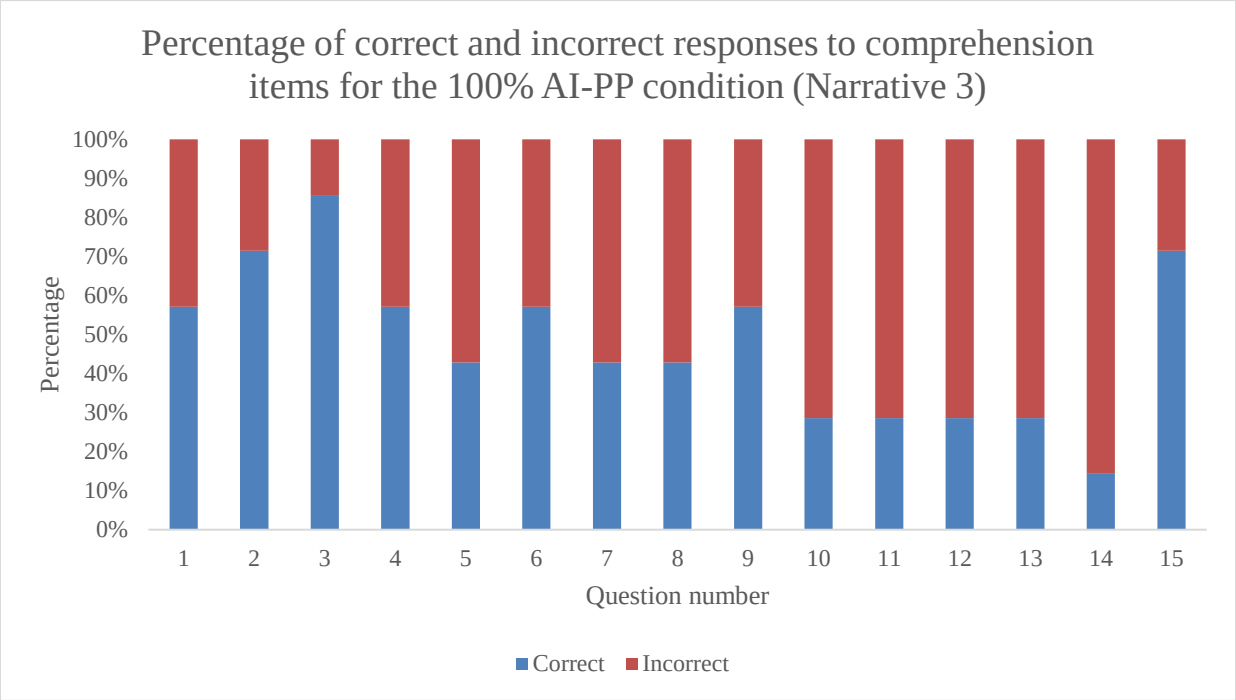

Figure 6. Percentage of correct and incorrect responses to comprehension items for Narrative 3 (100% AI-PP)

Statistical comparison of the individual comprehension items. A mixed model ANOVA using the LSD procedure (p = .05) was conducted to compare the effect of the different conditions on the factual and the inferential questions separately. The 10 factual questions from

each narrative consisted of questions where the required responses alluded to facts that were directly stated in the associated narrative. When focusing on these factual questions alone, statistics showed no significant difference between the average accuracy scores across the three conditions, with F(2, 12) = 0,31, p = 0.74 as illustrated in Figure 7.

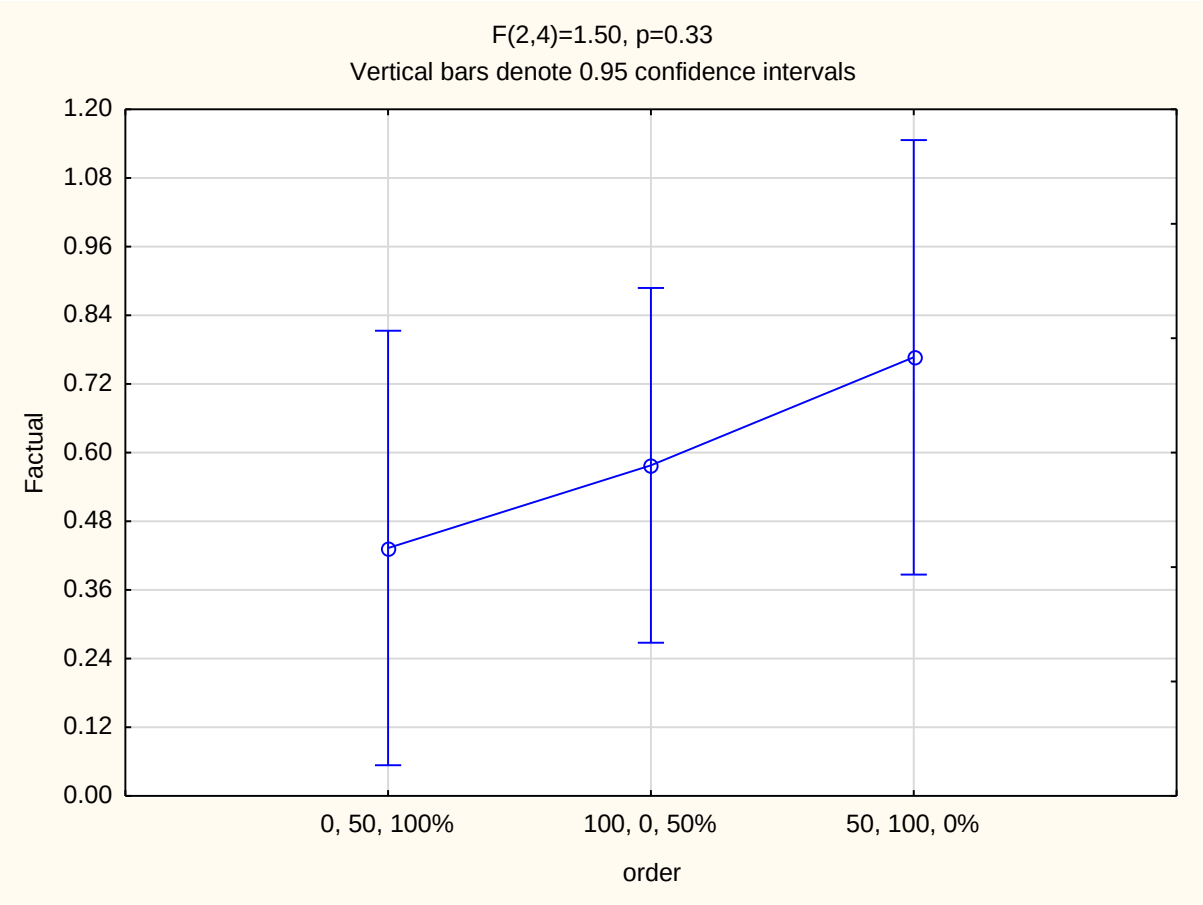

Figure 7. Average accuracy scores of factual questions across the three conditions

The 5 inferential questions from each narrative consisted of questions where the required responses were not directly stated in the narratives but had to be deduced from the given information. When focusing on these inferential questions alone, the average accuracy scores showed a significant difference across the three conditions, with F(2, 12) = 4,26, p = 0.04, as

illustrated in Figure 8. There was no significant difference between the 0 and 100% AI-PP conditions ($p = 0.32$) when examining the average accuracy scores of the inferential questions. However, the p-value was 0.01 between the average accuracy score of the 50% and 100% AI-PP conditions. The participants therefore did significantly better during the 50% than the 100% condition when answering the inferential questions. The p-value of 0.09 between the average accuracy scores of the 0% and 50% conditions with the inferential questions, albeit not significant, shows a statistical trend towards participants faring better during the 50% condition. The effect size between the 0% and 100% AI-PP conditions with the inferential questions was determined as medium (0.43). However, the effect size was shown to be large (0.82 and 1.03) when looking at the difference between the 0% and 50% and the 50% and 100% AI-PP conditions respectively.

Figure 8 graphically depicts these average accuracy scores of the inferential questions.

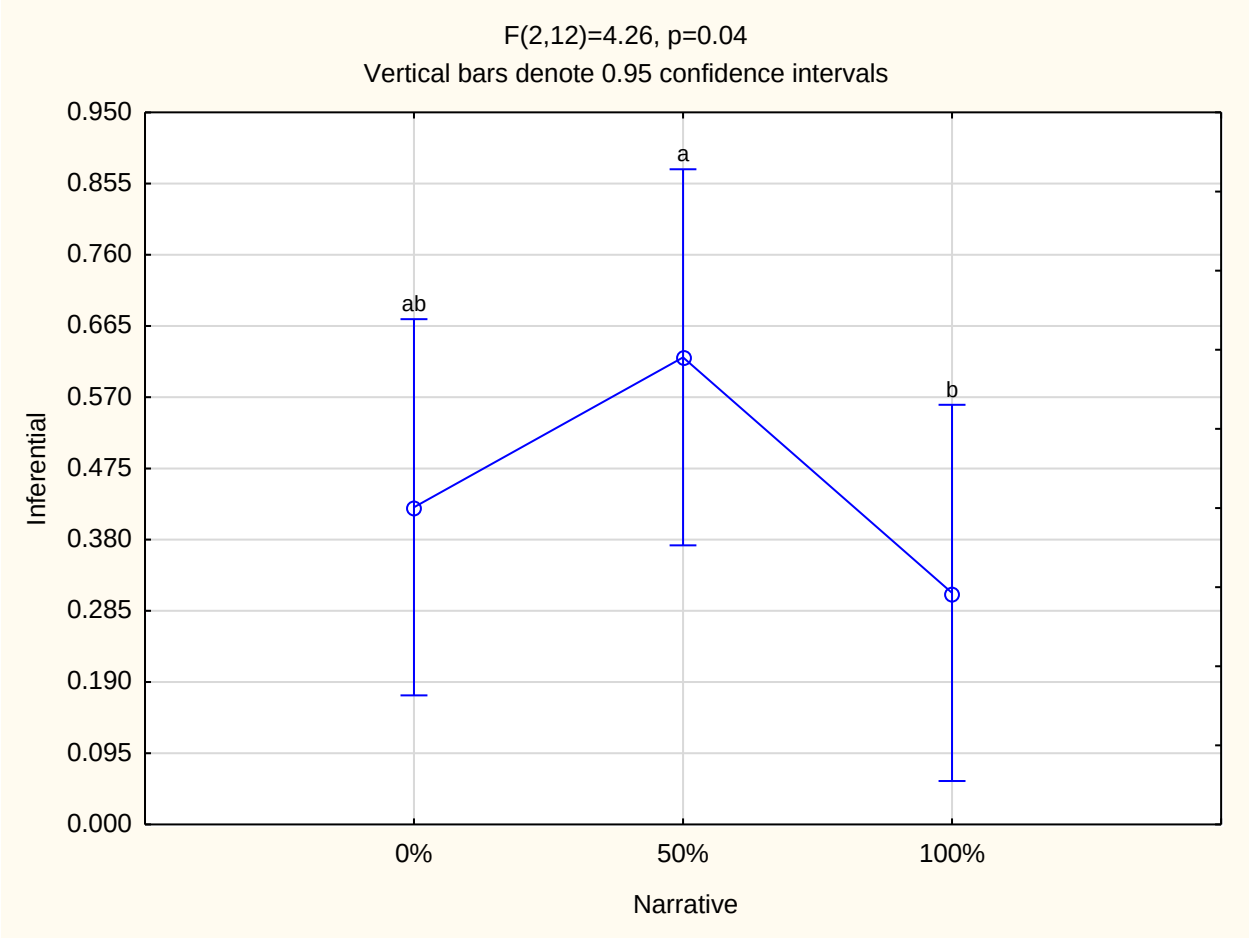

Figure 8. Average accuracy scores of inferential questions across the three conditions

Discussion

The majority of the participants (4 out of 7) achieved the highest accuracy scores in the 50% AI-PP condition. The average accuracy score was also the highest in the 50% AI-PP condition (61,9% correct answers). In the study by Dada et al. (2019), researchers examined the effect of augmented input and no augmented input on the auditory comprehension of people with chronic aphasia using the same narratives as the current study and found that the majority of participants (58.33%) had more accurate scores during the augmented input condition (in their case, this was 70% AI-PP).

In the current study and in the study by Dada et al. (2019), the same narrative was used for the 0% AI-PP condition, with participants achieving an average accuracy score of 54,29% and 56.67% respectively. In both studies there was no significant difference between the 0% and the AI-PP conditions. As there was an increase in average accuracy scores when the frequency of AI-PP was increased in the Dada et al. (2019) study, and between the 0% and 50% conditions in the current study, one would expect the highest average accuracy score in the current study's 100% AI-PP condition. The same narrative was used in both the 70% AI-PP in the study by Dada et al. (2019) and the 100% AI-PP condition in the current study. However, interestingly enough, the average response accuracy of the 100% AI-PP condition was only 47,62%, leading to a significantly lower average accuracy score than that of the 50% AI-PP condition.

What this may mean is that AI-PP as a means of supporting narrative auditory comprehension tasks seems to facilitate improved auditory comprehension of narratives for some persons with Wernicke's aphasia. This is in line with Dietz et al. (2014), who support the idea that pre-task stimulation is deemed beneficial for comprehension, and with Wallace et al. (2018) who support the idea of combining modalities for improved comprehension for PWA. However, a too high frequency of AI-PP (in this case 100%) may be detrimental to the auditory

comprehension of narratives for some persons with Wernicke's aphasia. The same resource allocation theory that could help explain why augmented input may be beneficial for auditory comprehension could be used to explain why too much augmented input may be disadvantageous.

The terms attention, processing resources, capacity and cognitive effort are used interchangeably within the resource allocation theory to refer to a pool of resources, where the allocation towards one task will result in decreased performance for one task and increased performance for the other (McNeil et al., 2004; Slansky & McNeil, 1997). Augmented input supports may increase the ability of PWA to allocate resources to unfamiliar listening tasks by stimulating prior knowledge and lessening the cognitive load (Wallace et al., 2012). However, during the 100% AI-PP condition, the attentional demands of the tasks increased (i.e., all the PCS pictures may be distracting; too much to look at during the competing task of listening to the narrative). Narrative 3 with the 100% AI-PP might therefore have been too "attention demanding" (McNeil et al., 2004, p. 540), possibly leading to a significant disruption in auditory processing (Murray, Viehman, & Lippa, 2006).

Auditory Comprehension Difficulties and Response Accuracy

Dada et al. (2019) and Wallace et al. (2012) found that PWA with less severe auditory comprehension difficulties performed more accurately overall in comprehension tasks than those participants with more severe ratings of aphasia. This was not the case with the current study, as the participant with the second highest auditory verbal comprehension score on the WAB-R had the lowest response accuracy across all three conditions. The three participants with auditory comprehension scores below 6 also scored similarly to a participant with a score over 6. The current study was, however, focused on persons with Wernicke's aphasia while Dada et al.

(2019) and Wallace et al. (2012) had different types of aphasia in one study. The participant population of the current study was therefore more homogenous and could explain why their auditory comprehension scores did not influence their response accuracy as much as it did in the aforementioned studies.

Furthermore, individual analysis did not reveal any patterns associated with the auditory verbal comprehension score on the WAB-R (Kertesz, 2006) and accuracy of responses to comprehension items between the three conditions. In other words, some participants with more severe auditory comprehension difficulties did not benefit more from the AI-PP conditions, and at times had more accurate responses during the no augmented input condition. Similarly, some participants with milder auditory comprehension difficulties performed better in one of the conditions when compared to their responses in another condition. This finding is similar to previous research completed by Brennan et al. (2005), Dada et al. (2019), Rose et al. (2011) and Wallace et al. (2012), in which no significant differences between different supports were found, and in which performance patterns across the different conditions were not related to independent variables such as aphasia severity.

For example, Participant 1 had the highest accuracy scores across all three conditions, even though three other participants presented with higher auditory comprehension scores than his. The fact that this participant is the only one with a postgraduate degree could contribute to his higher accuracy scores. There is evidence that persons with aphasia are inclined to fare better with speech and language therapy outcomes when they have higher education levels (Laska, Kahan, Hellblom, Murray, & Von Arbin, 2011).

Participant 1 was also the only one receiving speech therapy intervention at the time, which could also contribute to his higher than expected accuracy scores. It is largely agreed that

aphasia therapy can be effective; more specifically, PWA will have better chances of recovery if they receive intervention (Basso & Caporali, 2001; Basso & Macis, 2011; Pulvermuller & Berthier, 2008). Linguistic competence is especially important for this study as the participants would need to understand the language code of the augmented input, in this case the no-context PCS images, to effectively benefit from it (Light & McNaughton, 2014). An aspect of acquiring linguistic competence is receptive and expressive skills, aspects that are targeted during Participant's 1 therapy.

On the other hand, the participant that fared the best during the 100% AI-PP condition was also the only participant with an aphasia quotient severity rating of severe. This could possibly tie in with the finding by Brown et al. (2019) that persons with severe aphasia showed significantly more accurate performances during a combined modality condition than during the single modality condition, whereas persons with mild to moderate aphasia showed only a slight accuracy difference across the different conditions. In the current study, all the conditions were combined modalities, but the condition where the severe participant fared the best was the condition with the most support in terms of frequency.

Another possible explanation for the lack of a pattern between the auditory comprehension and task accuracy scores could be linked to the complex influence of bilingualism. In the Wallace et al. (2012) study all the participants' first language was English and in the Dada et al. (2019) study most participants' home language was English (9 out of 12). It is unclear how many of the participants in these two studies are bilingual. In the current study only 2 of the 7 participants' home language was English. However, all the participants were reported to be proficient in two languages, which is expected given the multilingual South African context (Coetzee-Van Rooy, 2018). There is some empirical evidence to suggest that

bilingualism may be associated with better cognitive outcomes post-stroke and lower severity scores on some aphasia measures (Paplikar, et al., 2019). In contrast, there is also some empirical evidence to suggest that bilingual non-native English speakers with aphasia perform worse on a range of language tasks compared to monolingual native English-speaking individuals with aphasia (Penn, Frankel, Watermeyer, & Russell, 2010). However, these non-native English-speaking participants were all immigrants; with the authors suggesting that they had poor premorbid language proficiency. Regardless, varied premorbid English proficiency as well as possible linguistic and cognitive benefits of bilingualism should both be acknowledged as potential reasons why the auditory comprehension scores did not influence response accuracy in the current study compared to previous studies.

Individual Comprehension Items

Similar findings in the studies by Dada et al. (2019) and Wallace et al. (2014) make it clear that PWA presented with higher accuracy during comprehension items related to factual stimuli, in comparison to inferential stimuli. The current study contributes to this finding by concluding that the same can be found with regard to persons with Wernicke's aphasia specifically. Interestingly, there is no significant difference between the AI-PP conditions when focusing on the factual questions specifically. However, for persons with Wernicke's aphasia, the 50% AI-PP significantly contributes more to accuracy than the 100% condition, and it has a tendency towards significantly contributing more to accuracy than with the 0% condition when focusing on inferential information. This finding provides a starting point for continued research into what forms of support can facilitate improved comprehension of inferential information for persons with Wernicke's aphasia.

Conclusion

In this study, the effect of varying frequencies of AI-PP on the auditory comprehension of people with Wernicke's aphasia was investigated. The research was conducted by having participants listen to three narratives in three conditions, namely 0%, 50% and 100% AI-PP, and then respond to comprehension items based on the narratives using the Written-choice Communication Strategy. The number of accurate responses for each of the conditions was calculated, and the three conditions were compared. Next, a summary of the main findings is presented, followed by the clinical implications of the study. The study is then critically evaluated in terms of its strengths and limitations, after which recommendations for future research are explored.

Summary of Main Findings

There was no obvious pattern that participants with less severe auditory comprehension difficulties had more accurate response overall than those participants with more severe auditory comprehension difficulties. Inferential statistics indicated no significant difference between the three conditions; however, the majority of the participants (4 of the 7) had more accurate scores during the 50% AI-PP condition. The lack of significant overall findings may be related to the small sample size. Overall, however, participants performed significantly better during the 50% than during the 100% condition. Additionally, it was found that the participants with Wernicke's aphasia generally presented with higher accuracy during comprehension items related to factual stimuli, in comparison to inferential stimuli. Nevertheless, when looking at the inferential questions in isolation, the participants did significantly better during the 50% AI-PP condition than during the 100% AI-PP condition.

Clinical Implications

This study represents a preliminary step to investigate how AI-PP can support auditory comprehension of narratives for persons with Wernicke's aphasia. The main clinical implication is that supporting narrative auditory comprehension tasks with high-context images as augmented input and no-context PCS images and keywords as AI-PP, used as pre-task and during-task stimulation, seems to facilitate the improved auditory comprehension of narratives for some persons with Wernicke's aphasia. However, the frequency of the provided AI-PP is an important variable influencing auditory comprehension of persons with Wernicke's aphasia. The implication is that providing AI-PP for half of the content units of a narrative is more beneficial than providing no augmented input for some people with Wernicke's aphasia. However, providing AI-PP for all the content units of a narrative seems to have a negative effect on the auditory comprehension of some persons with Wernicke's aphasia.

Critical Evaluation

Strengths. One of the strengths of this study is that it is one of only a few studies that focuses primarily on Wernicke's aphasia. It is only the second study that focuses on the effect of AI-PP at varying frequencies on auditory comprehension of narratives for persons with aphasia, and possibly the first to focus specifically on Wernicke's aphasia primarily. Furthermore, the design of the study permitted each participant to be exposed to every condition in the experiment, enabling comparisons to be made between the three conditions. The randomization of the order conditions across participants controlled for order and carryover effect further strengthened the study. The participants were also grouped by varying severity to reduce the risk that the more severe participants received less support by chance.

Another strength of the study is the use of pre-task stimulation, which current literature has proposed to be a vital consideration during comprehension tasks. Researchers suggest that pre-task stimulation stimulates prior knowledge and allows the person with aphasia to allocate resources more effectively to a task (Dietz et al., 2014; Wallace et al., 2012). Further strengthening the study is the use of both linguistic and visual supports as augmented input. Research has shown that communication partners using multiple modalities to support comprehension during interactions with PWA improve the quality of the interaction (Garrett & Beukelman, 1995; Lasker et al., 1997).

The fact that most of the materials used in the study, namely the high-context images, narratives and comprehension items, were previously used in peer-reviewed published articles is another strength of the study (Dada et al., 2019.; Wallace et al., 2012). Data collection was also done with the help of a script, contributing to high procedural integrity throughout the study.

Limitations. A small sample size is the main limitation of the study, as only seven participants with Wernicke's aphasia took part in the study. The strict selection criteria resulted in a very specific population of participants, which implied a challenging recruitment process. Due to the small sample size, the results of this study have limited generalizability.

Furthermore, purposive sampling was used to recruit participants as they were selected based on specific pre-determined selection criteria. This type of sampling is beneficial for a small sample pool, but a limitation of this sampling is the non-random selection of participants, as the researcher is biased in choosing the subjects of the study due to the pre-determined selection criteria.

Recommendations for Further Studies

Several recommendations for future research are evident from this study. First, it is

recommended that this study be replicated with a larger sample of adults with Wernicke's aphasia to ensure more robust statistical analysis. This study could also be replicated using participants of other aphasia types to determine what frequency of augmented input best supports differing types and severities of aphasia. Studies have shown varied performance during comprehension tasks within different aphasia severity groups (Brown, 2018; Rose et al., 2011). Future research is needed to study participants systematically to allow severity analysis; for example, targeting only one or two types of aphasia. This is necessary to establish an evidence base to inform clinical practice regarding what augmented input is beneficial for whom and under what circumstances (Wallace et al., 2018).

The type of images that researchers use in their experimental tasks influences outcomes during comprehension tasks. The current study lacked resources with personal relevance to the participants. Prior studies have shown that PWA perform better in auditory comprehension tasks when the materials are personally relevant (McKelvey et al., 2010). Wilson and Read (2016) also found a higher mean number of correct responses for text combined with a photograph, in comparison to text combined with ClipArt. Another recommendation for future research is therefore that the study be replicated using photographs or personal images instead of the PCS images to examine the effect these visual supports have on the auditory comprehension of persons with Wernicke's aphasia during narrative tasks.

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Appendix A

Permission from the Research Ethics Committee

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Research Ethics Committee

18 February 2019

Dear Ms Leuvennink

Project:	**The effect of frequency of augmented input on the auditory comprehension of narratives for persons with Wernicke's aphasia**
Researcher:	**J Leuvennink**
Supervisors:	**Prof S Dada**
Department:	**Centre for Augmentative and Alternative Communication**
Reference number:	**17352194 (GW20181021HS)**

Thank you for your response to the Committee's correspondence.

The application was **approved** by the **Research Ethics Committee** on 18 February 2019. Data collection may therefore commence.

Please note that this approval is based on the assumption that the research will be carried out along the lines laid out in the proposal. Should the actual research depart significantly from the proposed research, it will be necessary to apply for a new research approval and ethical clearance.

We wish you success with the project.

Sincerely

Prof Maxi Schoeman
Deputy Dean: Postgraduate and Research Ethics
Faculty of Humanities
UNIVERSITY OF PRETORIA
e-mail: [redacted]

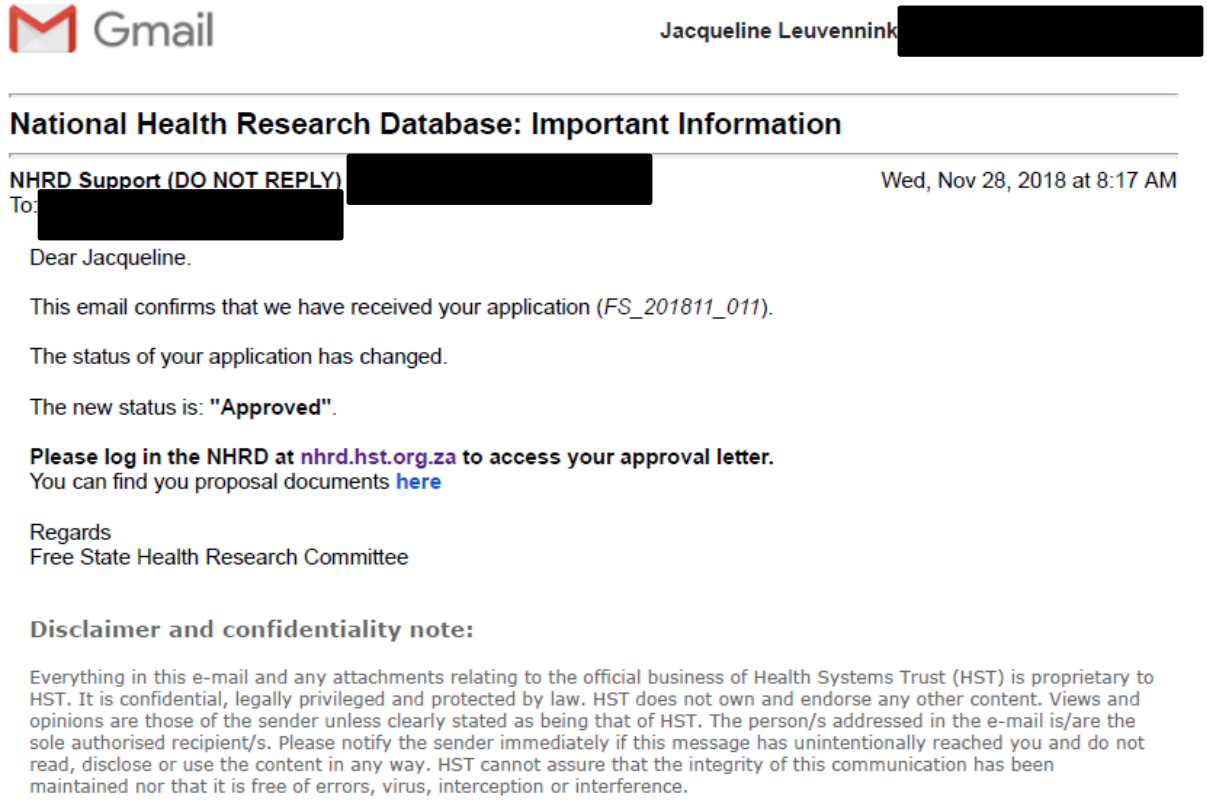
cc: Prof S Dada (Supervisor) Prof J Bornman (HoD)

Fakulteit Geesteswetenskappe
Lefapha le Bomotho

Research Ethics Committee Members: Prof MME Schoeman (Deputy Dean); Prof KL Harris; Mr A Bizos; Dr L Blokland; Dr K Booyens; Dr A-M de Beer; Ms A dos Santos; Dr R Fasselt; Ms KT Govinder Andrew; Dr E Johnson; Dr W Kelleher; Mr A Mohamed; Dr C Puttergill; Dr D Reyburn; Dr M Soer; Prof E Taljard; Prof V Thebe; Ms B Tsebe; Ms D Mokalapa

Appendix B

Permission from the Free State Department of Health



Gmail Jacqueline Leuvennink [redacted]

National Health Research Database: Important Information

NHRD Support (DO NOT REPLY) [redacted] Wed, Nov 28, 2018 at 8:17 AM
To: [redacted]

Dear Jacqueline.

This email confirms that we have received your application (*FS_201811_011*).

The status of your application has changed.

The new status is: **"Approved"**.

Please log in the NHRD at nhrd.hst.org.za to access your approval letter.
You can find you proposal documents **here**

Regards
Free State Health Research Committee

Disclaimer and confidentiality note:

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Appendix C

Permission Letter to Hospital/Clinic Managers

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

PERMISSION LETTER TO HOSPITAL/CLINIC MANAGERS

Dear Sir/Madam

Request for permission to recruit participants for Masters research from your facility

My name is Jacqueline Leuvennink and I am a speech-language therapist. I am currently enrolled for a Masters degree at the Centre for Augmentative and Alternative Communication (CAAC) at the University of Pretoria. In order for me to comply with the requirements set to complete my degree, I have to complete a research study. The research study is being conducted under the supervision of Professor Shakila Dada.

I would like to request your permission to recruit suitable participants from your facility for my study described below. The research will be conducted at the facility or at the participant's home (dependent on the participant).

Title of the study

"The effect of frequency of augmented input on the auditory comprehension of narratives for persons with Wernicke's aphasia".

Rationale for the study

Augmented input (AI) is any linguistic or visual strategy used by communication partners to increase the message comprehension of an individual with aphasia. Auditory comprehension is supported by AI strategies through highlighting prominent information provided by the communication partners, thereby reducing the cognitive load and amplifying former knowledge. Persons with Wernicke's aphasia's capacity to understand visual modalities such as written words and pictures, is significantly less impaired than their auditory modalities and therefore AI is a viable support option for this population. Previous research has predominantly focused on the various types of AI that can be used, and only one study has been done on the frequency of partner-pointing needed to support auditory comprehension of persons with aphasia. Further research is therefore needed to determine what frequency of partner-pointing will aid improved auditory comprehension for persons with aphasia, specifically Wernicke's aphasia.

Objectives of the study

The main aim of the study is to determine the effect of frequency with partner-pointing augmented input on the auditory comprehension of narratives for persons with Wernicke's aphasia.

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Centre for Augmentative and Alternative Communication, Room 2-36, Com path Building, Lynnwood Road
University of Pretoria, Private Bag X20
Hatfield 0028, South Africa
Tel +27 (0)12 420 2001
Fax +27 (0) 86 5100841
Email saak@up.ac.za
www.caac.up.ac.za

Participants

Potential participants must have a classification of Wernicke's aphasia, secondary to a left-hemisphere stroke that occurred at least six months previously. Participants must be proficient in English, with no history of language or cognitive disability prior to the stroke, and normal or corrected hearing and vision. Participants must also have a significant other (family member or friend).

Summary of research procedures

The study aims to recruit a minimum of twelve persons with Wernicke's aphasia following a left stroke, along with a significant other (family member or friend). Informed consent will be obtained by explaining the purpose, expected duration and procedure of the study to both the participant and their significant others. Additional actions will be taken to ensure that the persons with Wernicke's aphasia can provide informed consent without being coerced. This includes writing the information in basic English and including visual aids to enhance understanding. The significant other will be present to observe and help the person with Wernicke's aphasia give their consent and is requested to ensure that the person with Wernicke's aphasia understands the study and is not being coerced. As persons with Wernicke's aphasia are known to have reduced comprehension, consent will also be obtained from the significant other. All participants and significant others will be informed that participation in the study is voluntary and that they have the right to withdraw at any time without any consequences.

The participants will be met individually, with their significant other, on one occasion. During this meeting, the purpose of the study will be discussed, and informed consent obtained. The participants will then be screened using the Western Aphasia Battery – Revised, a visual perceptual skills screening test and the Written Choice Strategy screening test. This will take approximately one hour. Following this, the participant and their significant other will be offered a short comfort break. The experimental tasks will commence after the break.

During the experimental conditions, participants will be read three narratives; one with no augmented partner-pointing, one with 50% augmented partner-pointing and one with 100% partner-pointing. Then the participants will be required to answer questions based on the narratives. These experimental sessions will be video-recorded to check for treatment integrity. Only the researcher, researcher assistant and the research supervisor will view these recordings. These tasks will take approximately 30 minutes. Participants will receive a small token of appreciation at the end of the study to thank them for participating.

What is expected from your facility

Should you provide permission, the researcher will ask the managers and the rehabilitation team in the facility to help with the identification of potential participants. Those persons meeting the criteria will be asked if they are willing to participate and a meeting time for the experimental sessions will be negotiated with the interested individuals.

Access to results of study

The results of the study are intended to be published in the format of a mini dissertation, and possibly in a publication and a discussion at a conference. The participants' and significant others' names will not be disclosed, and confidentiality will be maintained at all times. All data pertaining

to this study will be stored at the Centre for Alternative and Augmentative Communication at the University of Pretoria for 15 years for archiving.

I would appreciate your consideration of my request. Should you grant permission, please sign the reply slip. After permission has been obtained from you, permission will be requested from individual governmental hospital and clinic management in the disclosed districts. For any further information, please do not hesitate to contact met on the details supplied below.

Yours sincerely

Jacqueline Leuvennink
Student

Prof. Shakila Dada
Supervisor

[redacted]

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

LETTER FROM MANAGER OF HOSPITAL/CLINIC

I ..... as the manager of

..... have read and understood the information pertaining to the study and give consent to assist with recruiting participants for the study.

Signature..... Date.....

Place.....

Researcher: Jacqueline Leuvennink

Signature  Date.....

Place.....

Official Stamp

Centre for Augmentative and Alternative Communication, Room 2-36, Com path Building, Lynnwood Road
University of Pretoria, Private Bag X20
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Appendix D

Permission Letter to Private Practice Owner

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

PERMISSION LETTER TO PRIVATE PRACTICE OWNER

Dear Sir/Madam

Request for permission to recruit participants for Masters research from practice

My name is Jacqueline Leuvennink and I am a speech-language therapist. I am currently enrolled for a Masters degree at the Centre for Augmentative and Alternative Communication (CAAC) at the University of Pretoria. In order for me to comply with the requirements set to complete my degree, I have to complete a research study. The research study is being conducted under the supervision of Professor Shakila Dada.

I would like to request your permission to recruit suitable participants from your practice for my study described below. The research will be conducted at the participant's home.

Title of the study

"The effect of frequency of augmented input on the auditory comprehension of narratives for persons with Wernicke's aphasia".

Rationale for the study

Augmented input (AI) is any linguistic or visual strategy used by communication partners to increase the message comprehension of an individual with aphasia. Auditory comprehension is supported by AI strategies through highlighting prominent information provided by the communication partners, thereby reducing the cognitive load and amplifying former knowledge. Persons with Wernicke's aphasia's capacity to understand visual modalities such as written words and pictures, is significantly less impaired than their auditory modalities and therefore AI is a viable support option for this population. Previous research has predominantly focused on the various types of AI that can be used, and only one study has been done on the frequency of partner-pointing needed to support auditory comprehension of persons with aphasia. Further research is therefore needed to determine what frequency of partner-pointing will aid improved auditory comprehension for persons with aphasia, specifically Wernicke's aphasia.

Objectives of the study

The main aim of the study is to determine the effect of frequency with partner-pointing augmented input on the auditory comprehension of narratives for persons with Wernicke's aphasia.

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

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Tel +27 (0)12 420 2001
Fax +27 (0) 86 5100841
Email saak@up.ac.za
www.caac.up.ac.za

Participants

Potential participants must have a classification of Wernicke's aphasia, secondary to a left-hemisphere stroke that occurred at least six months previously. Participants must be proficient in English, with no history of language or cognitive disability prior to the stroke, and normal or corrected hearing and vision. Participants must also have a significant other (family member or friend).

Summary of research procedures

The study aims to recruit a minimum of twelve persons with Wernicke's aphasia following a left stroke, along with a significant other (family member or friend). Informed consent will be obtained by explaining the purpose, expected duration and procedure of the study to both the participant and their significant others. Additional actions will be taken to ensure that the persons with Wernicke's aphasia can provide informed consent without being coerced. This includes writing the information in basic English and including visual aids to enhance understanding. The significant other will be present to observe and help the person with Wernicke's aphasia give their consent and is requested to ensure that the person with Wernicke's aphasia understands the study and is not being coerced. As persons with Wernicke's aphasia are known to have reduced comprehension, consent will also be obtained from the significant other. All participants and significant others will be informed that participation in the study is voluntary and that they have the right to withdraw at any time without any consequences.

The participants will be met individually, with their significant other, on one occasion. During this meeting, the purpose of the study will be discussed, and informed consent obtained. The participants will then be screened using the Western Aphasia Battery – Revised, a visual perceptual skills screening test and the Written Choice Strategy screening test. This will take approximately one hour. Following this, the participant and their significant other will be offered a short comfort break. The experimental tasks will commence after the break.

During the experimental conditions, participants will be read three narratives; one with no augmented partner-pointing, one with 50% augmented partner-pointing and one with 100% partner-pointing. Then the participants will be required to answer questions based on the narratives. These experimental sessions will be video-recorded to check for treatment integrity. Only the researcher, researcher assistant and the research supervisor will view these recordings. These tasks will take approximately 30 minutes. Participants will receive a small token of appreciation at the end of the study to thank them for participating.

What is expected from your facility

Should you provide permission, the researcher will ask the managers and the rehabilitation team in the facility to help with the identification of potential participants. Those persons meeting the criteria will be asked if they are willing to participate and a meeting time for the experimental sessions will be negotiated with the interested individuals.

Access to results of study

The results of the study are intended to be published in the format of a mini dissertation, and possibly in a publication and a discussion at a conference. The participants' and significant others' names will not be disclosed, and confidentiality will be maintained at all times. All data pertaining

to this study will be stored at the Centre for Alternative and Augmentative Communication at the University of Pretoria for 15 years for archiving.

I would appreciate your consideration of my request. Should you grant permission, please sign the reply slip. For any further information, please do not hesitate to contact met on the details supplied below.

Yours sincerely

Jacqueline Leuvennink
Student

Prof. Shakila Dada
Supervisor

[redacted]

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

LETTER FROM PRIVATE PRACTICE OWNER

I ..... as the owner of

..... have read and understood the information pertaining to the study and give consent to assist with recruiting participants for the study.

Signature..... Date.....

Place.....

Researcher: Jacqueline Leuvennink

Signature  Date.....

Place.....

Centre for Augmentative and Alternative
Communication, Room 2-36, Com path
Building, Lynnwood Road
University of Pretoria, Private Bag X20
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Appendix E

Permission Letter to Non-Governmental Organizations

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

PERMISSION LETTER TO NON-GOVERNMENTAL ORGANIZATIONS (NGOs)

Dear Sir/Madam

Request for permission to recruit participants for Masters research from your NGO

My name is Jacqueline Leuvennink and I am a speech-language therapist. I am currently enrolled for a Masters degree at the Centre for Augmentative and Alternative Communication (CAAC) at the University of Pretoria. In order for me to comply with the requirements set to complete my degree, I have to complete a research study. The research study is being conducted under the supervision of Professor Shakila Dada.

I would like to request your permission to recruit suitable participants from your facility for my study described below. The research will be conducted at the facility or at the participant's home (dependent on the participant).

Title of the study

"The effect of frequency of augmented input on the auditory comprehension of narratives for persons with Wernicke's aphasia".

Rationale for the study

Augmented input (AI) is any linguistic or visual strategy used by communication partners to increase the message comprehension of an individual with aphasia. Auditory comprehension is supported by AI strategies through highlighting prominent information provided by the communication partners, thereby reducing the cognitive load and amplifying former knowledge. Persons with Wernicke's aphasia's capacity to understand visual modalities such as written words and pictures, is significantly less impaired than their auditory modalities and therefore AI is a viable support option for this population. Previous research has predominantly focused on the various types of AI that can be used, and only one study has been done on the frequency of partner-pointing needed to support auditory comprehension of persons with aphasia. Further research is therefore needed to determine what frequency of partner-pointing will aid improved auditory comprehension for persons with aphasia, specifically Wernicke's aphasia.

Objectives of the study

The main aim of the study is to determine the effect of frequency with partner-pointing augmented input on the auditory comprehension of narratives for persons with Wernicke's aphasia.

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Lefapha la Bomotho

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Email saak@up.ac.za

Participants

Potential participants must have a classification of Wernicke's aphasia, secondary to a left-hemisphere stroke that occurred at least six months previously. Participants must be proficient in English, with no history of language or cognitive disability prior to the stroke, and normal or corrected hearing and vision. Participants must also have a significant other (family member or friend).

Summary of research procedures

The study aims to recruit a minimum of twelve persons with Wernicke's aphasia following a left stroke, along with a significant other (family member or friend). Informed consent will be obtained by explaining the purpose, expected duration and procedure of the study to both the participant and their significant others. Additional actions will be taken to ensure that the persons with Wernicke's aphasia can provide informed consent without being coerced. This includes writing the information in basic English and including visual aids to enhance understanding. The significant other will be present to observe and help the person with Wernicke's aphasia give their consent and is requested to ensure that the person with Wernicke's aphasia understands the study and is not being coerced. As persons with Wernicke's aphasia are known to have reduced comprehension, consent will also be obtained from the significant other. All participants and significant others will be informed that participation in the study is voluntary and that they have the right to withdraw at any time without any consequences.

The participants will be met individually, with their significant other, on one occasion. During this meeting, the purpose of the study will be discussed, and informed consent obtained. The participants will then be screened using the Western Aphasia Battery – Revised, a visual perceptual skills screening test and the Written Choice Strategy screening test. This will take approximately one hour. Following this, the participant and their significant other will be offered a short comfort break. The experimental tasks will commence after the break.

During the experimental conditions, participants will be read three narratives; one with no augmented partner-pointing, one with 50% augmented partner-pointing and one with 100% partner-pointing. Then the participants will be required to answer questions based on the narratives. These experimental sessions will be video-recorded to check for treatment integrity. Only the researcher, researcher assistant and the research supervisor will view these recordings. These tasks will take approximately 30 minutes. Participants will receive a small token of appreciation at the end of the study to thank them for participating.

What is expected from your facility

Should you provide permission, the researcher will ask the managers and the rehabilitation team in the facility to help with the identification of potential participants. Those persons meeting the criteria will be asked if they are willing to participate and a meeting time for the experimental sessions will be negotiated with the interested individuals.

Access to results of study

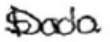
The results of the study are intended to be published in the format of a mini dissertation, and possibly in a publication and a discussion at a conference. The participants' and significant others' names will not be disclosed, and confidentiality will be maintained at all times. All data pertaining

names will not be disclosed, and confidentiality will be maintained at all times. All data pertaining to this study will be stored at the Centre for Alternative and Augmentative Communication at the University of Pretoria for 15 years for archiving.

I would appreciate your consideration of my request. Should you grant permission, please sign the reply slip. For any further information, please do not hesitate to contact met on the details supplied below.

Yours sincerely

Jacqueline Leuvennink
Student



Prof. Shakila Dada
Supervisor

[redacted]

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

LETTER FROM MANAGER OF NGO

I ..... as the manager of

..... have read and understood the information pertaining to the study and give consent to assist with recruiting participants for the study.

Signature..... Date.....

Place.....

Researcher: Jacqueline Leuvennink

Signature  Date.....

Place.....

Official Stamp

Centre for Augmentative and Alternative Communication, Room 2-36, Com path Building, Lynnwood Road
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Appendix F

Letter of Consent from Person with Wernicke's Aphasia

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

LETTER OF CONSENT FROM PERSON WITH WERNICKE'S APHASIA

Dear Sir/Madam

My name is Jacqueline Leuvennink. I am a speech therapist and I am also a student at the University of Pretoria. Thank you for meeting with me. I want to do a study to find out if pictures help you to understand better. I want to ask you if you will work with me today. If you say yes, this is what we will do:

I will ask you some questions and we will do a few tests to see if you can help me with this study.

If you are able to help me, we will read three stories. I will show you pictures to help you understand the story while we read it. Then you will have to answer some questions about the story.

I will video-record us together doing these tasks. The video-recording is only for the research and no one outside the research will see it. Your name will also not be used anywhere.

It is up to you if you want to take part in the study. If at any time during the study you change your mind, you can ask to stop and we will stop immediately. There is no problem if you want to stop!

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www.caac.up.ac.za

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

No harm will come to you during the study.

In the end, I hope the information from this study will help us to find better ways to help people that struggle to understand after a stroke.

I will now ask you if you want to take part in the study. Here is what the YES will look like if you would rather point:

And this is what the NO will look like:

	Do you have any questions about the study?		
	Do you understand that it is your choice to participate in the study?		

	Is it okay with you that I will be video-taping what we are going to do?		
	Do you understand that we can stop anytime you want to? You do not have to say why you want to stop.		
	Do you want to take part in the study?		

Name_____ **Date:** _____

Signature: _____ **Place:** _____

Researcher: Jacqueline Leuvennink **Date:** _____

Signature:  **Place:** _____

Appendix G

Letter of Consent from Significant Other

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

LETTER OF CONSENT FROM SIGNIFICANT OTHER

Dear Sir/Madam

Request to participate in a research study

Thank you for agreeing to meet me in order to obtain more information on the study, and to discuss your participation.

My name is Jacqueline Leuvennink and I am a speech-language therapist. I am currently enrolled for a Master's degree in Augmentative and Alternative Communication (AAC) at the University of Pretoria. In order for me to comply with the requirements set to complete my degree, I have to complete a research study.

Title of study

"The effect of frequency of augmented input on the auditory comprehension of narratives for persons with Wernicke's aphasia".

Objectives and rationale for study

This study aims to determine and compare the effect of augmented input on the accuracy of responses to an auditory comprehension task based on a narrative, for persons with Wernicke's aphasia. Augmented input is a strategy that is used to help people with aphasia to better understand what is being said to them. This includes supplementing spoken language with pictures or words to help increase the understanding of the message.

What is expected from you

As a person who is a friend or a family member of an individual with aphasia, I would like to request your help in participating in the study. Participation is voluntary, and you may withdraw from the study at any time without any consequences. All information will be treated confidentially. A small token of appreciation will be given at the end of the study.

Should you provide consent, I will ask you to observe how I explain the study to your friend or family member with aphasia, and ensure that they understand. I would also like you to ensure that I am not coercing your friend or family member to participate in the study.

Should you provide consent, you will also be asked to complete, or help your family member or friend with aphasia to complete the biographical questionnaire. This should take about five to ten minutes. After this, your friend or family member will have some screening assessments done.

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

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www.caac.up.ac.za

This might take an hour. Your friend or family member will be offered a short comfort break if they wish, while the scoring of the screening procedures take place. Participants need to answer a specific number of questions correctly in the screening procedures before continuing onto the experimental task. If they do not score the required points, they will not continue with the experimental task. This does not mean that there is no hope for recovery for you friend or family member; it is just for the purposes of this study that they would not be qualifying for.

Summary of study procedures

If your friend or family member has the required scores during the screening procedures, the experimental condition will begin. This will entail your friend or family member with aphasia listening to three stories and being asked some questions on these stories. This will take approximately half an hour. The experimental task will be video-recorded. The recordings will only be viewed by the researcher, a research assistant, and the researcher's supervisor, to check for treatment integrity.

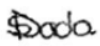
Access to results of study

The results of the study are intended to be published in the format of a Masters Mini dissertation, and possibly a publication and conference. Your name, as well as the name of your friend or family member with aphasia will not be disclosed, and confidentiality will be maintained at all times throughout the research process. All data pertaining to this study will be stored at the Centre for Augmentative and Alternative Communication at the University of Pretoria for 15 years for archiving. Should you wish to withdraw from the study, any data pertaining to you will be destroyed immediately.

I would appreciate your consideration of my request. For any further information, please do not hesitate to contact me. On the details provided below.

Yours sincerely

Jacqueline Leuvennink
Student
[redacted]



Prof. Shakila Dada
Supervisor
[redacted]

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

LETTER FROM SIGNIFICANT OTHER

I ..... as the significant other of

..... have read and understood the information pertaining to the study and give consent to partake in the study
study.

Signature..... Date.....

Place.....

Researcher: Jacqueline Leuvennink

Signature  Date.....

Place.....

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Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Appendix H

Biographical Questionnaire

Participant number	
Aphasia Quotient	

Please complete this form

1. What is your gender?

	Male
	Female

2. What is your date of birth?

d	d	m	m	y	y	y	y

3. What was the date of your stroke?

d	d	m	m	y	y	y	y

4. What is your home language?

	Afrikaans
	English
	isiNdebele
	isiXhosa
	isiZulu
	Sepedi
	Sesotho
	Setswana
	Siswati
	Venda
	Xitsonga
	Other

If other: Please specify _____

1. What is your highest level of education?

- ☐ Grade 9 or below
- ☐ Matric
- ☐ Diploma
- ☐ Degree
- ☐ Postgraduate degree
- ☐ Other

If other: Please specify _____

2. What was your occupation? (please specify)

_____

3. What is your marital status?

- ☐ Single
- ☐ Married
- ☐ Divorced
- ☐ Separated
- ☐ Widow/widower
- ☐ Other

If other: Please specify _____

8. What is currently the weak side of your body?

- ☐ Left
- ☐ Right

9. What hand did you write with before your stroke?

- ☐ Left
- ☐ Right

10. Do you use any mobility aid? (e.g. wheelchair, walking stick)

☐ Yes
☐ No

If yes, please specify _____

11. Do you have any problems with your vision?

☐ Yes
☐ No

12. if so, do you wear glasses?

☐ Yes
☐ No

13. Do you have any problems with your hearing?

☐ Yes
☐ No

14. If so, do you wear a hearing aid?

☐ Yes
☐ No

15. If you do wear a hearing aid, on what ear do you wear it?

☐ Left
☐ Right
☐ Both

16. Do you have any problems with remembering immediate information?

☐ Yes
☐ No

17. Did you have any language difficulties before the stroke?

☐ Yes
☐ No

If yes, please specify _____

18. Did you have any cognitive difficulties before the stroke?

☐ Yes
☐ No

If yes, please specify _____

19. Do you receive speech therapy?

☐ Yes
☐ No

20. How often do you receive speech therapy? (please specify**)**

_____

21. What is the focus of speech therapy?

_____

Appendix I

WAB-R

Participant number	
Aphasia Quotient	

Spontaneous Speech

A. Conversational Questions

Materials: Audio- or Video-tape Recorder (Optional)

Directions: Read the stimulus as written or substitute similar questions as appropriate (e.g., "What *was* your occupation?"). If you substitute a question, write it next to the question replaced.

Repetition: Repeat the question if the patient requests or does not appear to understand.

Recording Responses: Write the patient's response verbatim in the Response column. Place a checkmark (✓) in the Correct or Incorrect columns as appropriate.
Optional: Audiotape or videotape the patient's responses for later review.

Item	Response	Correct	Incorrect
1. **How are you today?**			
2. **Have you been here before?**			
3. **What is your first and last name?** (For incomplete responses, probe for first or last name.)	First Name Last Name		
4. **What is your full address?** (For incomplete responses, probe for the street, city, or state. No ZIP code is needed.)	Number & Street City State (Country)		
5. **What is your occupation?**			
6. **Why are you here (in the hospital)?** *or* **What seems to be the trouble?**			

B. Picture Description

Materials: Stimulus Book

Directions: Turn to page 1 in the Stimulus Book, and say, **Tell me what is happening in this picture.** If the patient lists single words, say, **Try to talk in sentences.** Ask for a more complete response if he or she produces only a few words. Encourage the patient to pay attention to all aspects of the picture. Move the picture toward the patient's intact visual field if necessary.

Recording Responses: Write the patient's response verbatim.

Scoring Information Content of Spontaneous Speech Tasks A and B

Directions: Circle the point value corresponding to the statement that best describes the information content of the patient's speech on Tasks A and B. Count recognizable phonemic paraphasias as correct.

0 = No information.
1 = Incomplete responses only (e.g., first name or last name only).
2 = Correct response to any 1 item in Task A.
3 = Correct responses to any 2 items in Task A.
4 = Correct responses to any 3 items in Task A.
5 = Correct responses to any 3 of the items in Task A plus some response to the picture in Task B.
6 = Correct responses to any 4 of the items in Task A plus some response to the picture in Task B.
7 = Correct responses to any 4 of the items in Task A and a mention of at least 6 things in the picture in Task B.
8 = Correct responses to any 5 of the items in Task A and an incomplete description of the picture in Task B.
9 = Correct responses to all items in Task A and an almost complete description of the picture in Task B; at least 10 people, objects, or actions should be named. Circumlocution may be present.
10 = Correct responses to all of the items in Task A and a reasonably complete description of the picture in Task B. Sentences of normal length and complexity, referring to most of the items and activities.

Information Content Score ☐

Scoring Fluency, Grammatical Competence, and Paraphasias of Spontaneous Speech Tasks A and B

Directions: Review the point values and corresponding statements. Circle the point value that best represents the fluency, grammatical competence, and occurrence of paraphasias in the patient's speech during Tasks A and B.

0 = No words or short, meaningless utterances.
1 = Recurrent, brief, stereotypic utterances with varied intonation; the emphasis or prosody may convey some meaning.
2 = Single words, often paraphasias, effortful and hesitant.
3 = Longer, recurrent stereotypic or automatic utterances without information, or mumbling.
4 = Halting, telegraphic speech; mostly single words; paraphasias; occasional prepositional phrases; severe word-finding difficulty. No more than two complete sentences with the exception of automatic sentences (e.g., "Oh I don't know."); characteristic of agrammatic, nonfluent aphasia.
5 = Often telegraphic but more fluent speech with some grammatical organization; marked word-finding difficulty. Paraphasias may be prominent; few, but more than two propositional sentences.
6 = More propositional sentences with normal syntactic patterns; may have paraphasias; significant word-finding difficulty and hesitations may be present.
7 = Phonemic jargon with semblance to English syntax and rhythm with varied phonemes and neologisms. May talk excessively; must be fluent; characteristic of severe Wernicke's aphasia.
8 = Circumlocutory, fluent speech; moderate word-finding difficulty; with or without paraphasias; may have semantic jargon. The sentences are often complete but may be irrelevant.
9 = Mostly complete, relevant sentences; occasional hesitations and/or paraphasias; some word-finding difficulty; near normal, but still perceptibly aphasic.
10 = Sentences of normal length and complexity, without definite slowing, halting, or paraphasias.

Fluency, Grammatical Competence, and Paraphasias Score ☐

Auditory Verbal Comprehension

A. Yes/No Questions

Materials: None

Directions: Say, **I'm going to ask you some questions. Answer Yes or No.** If the patient cannot respond consistently verbally or gesturally, train the patient to close his or her eyes to indicate Yes responses. Because aphasics often elaborate and circumlocute, it is particularly important to remind and reinforce the patient to respond Yes or No as requested.

Repetition: Repeat the directions and the question if the patient gives an ambiguous or confabulatory response.

Scoring: Indicate the type of response given by checking (✓) the box in the appropriate column. Score 3 points for each correct response and 0 points for each incorrect (ambiguous or confabulatory) response. If the patient self-corrects, score the last response he or she gives.

Item	Target Response	Type of Response				Score	
		Verbal	Gestural	Eye Blink	NR	Correct	Incorrect
1. Is your name Smith?	No					3	0
2. Is your name Brown?	No					3	0
3. Is your name _____? (Patient's last name)	Yes					3	0
4. Do you live in _____? (Nearby city/town where patient does not live)	No					3	0
5. Do you live in _____? (Patient's city/town of residence)	Yes					3	0
6. Do you live in _____? (Another nearby city/town where patient does not live)	No					3	0
7. Are you a man/woman?	Yes					3	0
8. Are you a doctor?	No					3	0
9. Am I a man/woman?	Yes					3	0
10. Are the lights on in this room?	Yes					3	0
11. Is the door closed?	Yes					3	0
12. Is this a hotel?	No					3	0
13. Is this _____? (Actual location)	Yes					3	0
14. Are you wearing red pajamas?	No					3	0
15. Will paper burn in fire?	Yes					3	0
16. Does March come before June?	Yes					3	0
17. Do you eat a banana before you peel it?	No					3	0
18. Does it snow in July?	No					3	0
19. Is a horse larger than a dog?	Yes					3	0
20. Do you cut the grass with an ax?	No					3	0

Yes/No Questions Score _____ (Max = 60)

B. Auditory Word Recognition

Materials: Stimulus Book, cup, matches, pencil, flower, comb, screwdriver

Directions: Refer to the specific directions for each set of items (e.g., Items 1–6; Items 7–36).

Repetition: Repeat each item one time if the patient requests or does not respond.

Scoring: Score correct responses as 1 point and incorrect responses as 0 points. If the patient points to more than one choice, score as 0, unless it is clear that the patient is self-correcting.

For Items 1–6, place objects in a random cluster, making sure they are within the patient's intact visual field if hemianopia is present. Say, **Point to the ___**, or **Show me the ___**.

Real Objects	Score
1. Cup	
2. Matches	
3. Pencil	
4. Flower	
5. Comb	
6. Screwdriver	

For Items 7–36, begin with page 2 in the Stimulus Book. Say, **Point to the ___**, or **Show me the ___**.

Pictured Objects	Score
7. Matches	
8. Cup	
9. Comb	
10. Screwdriver	
11. Pencil	
12. Flower	
Forms	**Score**
13. Square	
14. Triangle	
15. Circle	
16. Arrow	
17. Cross	
18. Cylinder	
Letters	**Score**
19. J	
20. F	
21. B	
22. K	
23. M	
24. D	
Numbers	**Score**
25. 5	
26. 61	
27. 500	
28. 1867	
29. 32	
30. 5000	

Colors	Score
31. Blue	
32. Brown	
33. Red	
34. Green	
35. Yellow	
36. Black	

For Items 37–42, if an object is not in the room, substitute a comparable item and note the substituted item. Say, **Point to the ___**, or **Show me the ___**.

Furniture	Score
37. Window	
38. Chair	
39. Desk/Bed	
40. Light	
41. Door	
42. Ceiling	

Body Parts	Score
43. Ear	
44. Nose	
45. Eye	
46. Chest	
47. Neck	
48. Chin	
Fingers	**Score**
49. Thumb	
50. Ring Finger	
51. Index Finger	
52. Little Finger	
53. Middle Finger	

For Items 54–60, the patient must get both the side (right or left) *and* body part correct to receive credit.

Right-Left on Body	Score
54. Right Ear	
55. Right Shoulder	
56. Left Knee	
57. Left Ankle	
58. Right Wrist	
59. Left Elbow	
60. Right Cheek	

Auditory Word Recognition Score ☐ (Max = 60)

C. Sequential Commands

Materials: Pen, comb, book

Directions: Say, **I am going to ask you to do some things.** Read each item.

Repetition: Repeat each item in its entirety one time if the patient requests or appears confused.

Scoring: Score the maximum point value if the patient correctly executes the entire command. If not, score each underlined segment of a multi-part command separately according to the number above the segment.

Item	Score
1. Raise[2] your hand.	(2)
2. Shut[2] your eyes.	(2)
3. Point[2] to the chair.	(2)
4. Point[2] to the window, then to the door.[2]	(4)

Arrange the pen, comb, and book (from left to right) on the table in front of the patient. Point to each and say, **See the pen, the comb, and the book? I will ask you to point to them and do things with them. Are you ready?** Proceed to Item 5. If the patient does not understand Item 5 say, **If I ask you to point to the pen with the comb, you would do this...** (demonstrate). Repeat Item 5.

5. Point[2] to the pen and the book.[2]	(4)
6. Point[4] with the pen to the book.[4]	(8)
7. Point[4] to the pen with the book.[4]	(8)
8. Point[4] to the comb with the pen.[4]	(8)
9. With the book[4] point to the comb.[4]	(8)
10. Put[4] the pen on top of the book,[6] then give[4] it to me.	(14)
11. Put[5] the comb on the other side of the pen[5] and turn over[5] the book.[5]	(20)

Sequential Commands Score ☐ (Max = 80)

Repetition

Materials: None

Directions: Say, **Repeat these words. Say ____.** Present the words in the order listed.

Repetition: Repeat each item one time if the patient requests or does not appear to hear the stimulus.

Scoring: Score the maximum point value if the patient correctly repeats the target word or phrase. Score 2 points for each recognizable word. Deduct 1 point for each phonemic paraphasia (e.g., shindow for window) and each error in word sequence. Give credit for responses that differ due to dysarthria (e.g., slurring), dialectal variations (e.g., winder/window), or word contractions (e.g., "He isn't coming back.").

Verbal Apraxia Rating: Rate phonemic substitutions, stuttering, repetition, segmentation, dysprosody and other features of verbal apraxia as absent, mild, moderate, or severe.

Item	Score
1. bed	(2)
2. nose	(2)
3. pipe	(2)
4. window	(2)
5. banana	(2)
6. snowball	(4)
7. forty-five	(4)
8. ninety-five percent	(6)
9. sixty-two and a half	(10)
10. The pastry cook was satisfied.	(10)
11. The telephone is ringing.	(8)
12. He is not coming back.	(10)
13. delicious freshly baked bread	(8)
14. no ifs, ands, or buts	(10)
15. Pack my box with five dozen jugs of liquid detergent.	(20)

Repetition Total ☐ (Max = 100)

Verbal Apraxia Rating:

☐ Absent ☐ Mild ☐ Moderate ☐ Severe

Naming and Word Finding

A. Object Naming

Materials: Book, ball, knife, cup, safety pin, hammer, toothbrush, eraser, (pad)lock, pencil, screwdriver, key, paper clip, watch, comb, rubber band, spoon, tape, fork, matches

Directions: Present the objects in the order listed. Say, **What is this?** or **What is the name of this object?** If the patient does not respond or responds incorrectly, ask him or her to hold the object (tactile cue) and to tell you what it is. If the patient still does not respond or responds incorrectly, present the first phoneme of the word (phonemic cue), or, if it is a compound word, the first half of the word (semantic cue).

Time Limit: Allow 20 seconds maximum for each item.

Scoring: Score 3 points if the object is named correctly or with a minor articulatory error (e.g., dysarthric slurring) and no cue is needed. Score 2 points if the object name is recognizable, but with a phonemic paraphasia (e.g., "fife" for "knife") and no cue is needed. If a tactile, phonemic, or semantic cue is needed, circle the *T*, the *P*, or the *S* in the Tactile, Phonemic, or Semantic column and score as 1 point. Score an incorrect or no response after cueing as 0 points.

Item	Other Response	Type of Cue (if needed)			Score			
		Tactile	Phonemic	Semantic				
1. Book		T	P	S	3	2	1	0
2. Ball		T	P	S	3	2	1	0
3. Knife		T	P	S	3	2	1	0
4. Cup		T	P	S	3	2	1	0
5. Safety Pin		T	P	S	3	2	1	0
6. Hammer		T	P	S	3	2	1	0
7. Toothbrush		T	P	S	3	2	1	0
8. Eraser		T	P	S	3	2	1	0
9. (Pad)lock		T	P	S	3	2	1	0
10. Pencil		T	P	S	3	2	1	0
11. Screwdriver		T	P	S	3	2	1	0
12. Key		T	P	S	3	2	1	0
13. Paper Clip		T	P	S	3	2	1	0
14. Watch		T	P	S	3	2	1	0
15. Comb		T	P	S	3	2	1	0
16. Rubber Band		T	P	S	3	2	1	0
17. Spoon		T	P	S	3	2	1	0
18. Tape		T	P	S	3	2	1	0
19. Fork		T	P	S	3	2	1	0
20. Matches		T	P	S	3	2	1	0

Object Naming Score ☐ (Max = 60)

B. Word Fluency

Materials: None
Directions: Say, **Name as many animals as you can in one minute.** If the patient is hesitant, cue him or her by saying, **Think of a domestic animal like the horse, or a wild animal like the tiger.** After 30 seconds, prompt the patient to continue if necessary.
Scoring: Score 1 point for each unique animal named (except for *horse* or *tiger* if given as an example), even if distorted by phonemic paraphasias.
Recording Responses: Write the patient's responses verbatim on the lines provided below.

_____

_____

_____

_____

_____

Word Fluency Score ☐ (Max = 20)

C. Sentence Completion

Materials: None
Directions: Say, **Complete what I say. For example, ice is . . .** (cold). Present the test items.
Scoring: Score 2 points if the target response or a reasonable alternative response is given (e.g., Sugar is . . . fattening). Score 1 point for a phonemic paraphasia or off-target alternative responses (e.g., Grass is . . . brown). Score 0 points for an unreasonable response (e.g., Grass is . . . cold).

Item	Target Response	Other Response	Score		
1. **The grass is ____.**	green		2	1	0
2. **Sugar is ____.**	sweet/white		2	1	0
3. **Roses are red, violets are ____.**	blue		2	1	0
4. **They fought like cats and ____.**	dogs		2	1	0
5. **Christmas is in the month of ____.**	December		2	1	0

Sentence Completion Score ☐ (Max = 10)

D. Responsive Speech

Materials: None
Directions: Say, **Answer the following questions.** Present the items.
Scoring: Score 2 points if the target response or a reasonable alternative response is given (e.g., Nurses work in a . . . clinic). Score 1 point for a phonemic paraphasia or off-target alternative responses (e.g., Nurses work in an...office). Score 0 points for an unreasonable response (e.g., Nurses work in a...store).

Item	Target Response	Other Response	Score		
1. **What do you write with?**	pen/pencil		2	1	0
2. **What color is snow?**	white		2	1	0
3. **How many days are in a week?**	seven		2	1	0
4. **Where do nurses work?**	hospital		2	1	0
5. **Where can you get stamps?**	post office/store		2	1	0

Responsive Speech Score ☐ (Max = 10)

Score Summary Worksheet

Western Aphasia Battery™ REVISED

Spontaneous Speech	Patient's Score
Information Content	(10) p. 3
Fluency, Grammatical Competence, and Paraphasias	(10) p. 3
Spontaneous Speech Total	(20)
(20)	Spontaneous Speech Score (Use to calculate AQ, LQ, and CQ)

Auditory Verbal Comprehension	
A. Yes/No Questions	(60) p. 4
B. Auditory Word Recognition	(60) p. 5
C. Sequential Commands	(80) p. 6
Auditory Verbal Comprehension Total	(200)
÷ 20	
(10)	Auditory Verbal Comprehension Score (Use to calculate AQ)
÷ 10	
(20)	Auditory Verbal Comprehension Score (Use to calculate LQ and CQ)

Repetition	
Repetition Total	(100) p. 7
÷ 10	
(10)	Repetition Score (Use to calculate AQ, LQ, and CQ)

Naming and Word Finding	
A. Object Naming	(60) p. 8
B. Word Fluency	(20) p. 9
C. Sentence Completion	(10) p. 9
D. Responsive Speech	(10) p. 9
Naming and Word Finding Total	(100)
÷ 10	
(10)	Naming and Word Finding Score (Use to calculate AQ, LQ, and CQ)

Aphasia Quotient (AQ)

(20)	Spontaneous Speech Score
(10)	Auditory Verbal Comprehension Score for AQ
(10)	Repetition Score
(10)	Naming and Word Finding Score
(50)	
× 2	
(100)	Aphasia Quotient (AQ)

WAB–R Aphasia Classification Criteria

Numbers in the Fluency column represent the Fluency, Grammatical Competence, and Paraphasias score. Numbers in the Auditory Verbal Comprehension, Repetition, and Naming and Word Finding columns represent section scores used to determine the Aphasia Quotient.

Directions: Compare the patient's four scores with the row of scores associated with each aphasia type to determine the WAB–R Aphasia Classification.

	Scores			
Aphasia Type	Fluency	Auditory Verbal Comprehension	Repetition	Naming & Word Finding
Global	<5	0–3.9	0–4.9	<7
Broca's	<5	4–10	0–7.9	<9
Isolation	<5	0–3.9	5–10	<7
Transcortical Motor	<5	4–10	8–10	<9
Wernicke's	>4	0–6.9	0–7.9	<10
Transcortical Sensory	>4	0–6.9	8–10	<10
Conduction	>4	7–10	0–6.9	<10
Anomic	>4	7–10	7–10	<10

Adapted with permission from Kertesz & Poole, 1974, *The Canadian Journal of Neurological Science, 1*(1), 7–16.

AQ = Aphasia Quotient LQ = Language Quotient CQ = Cortical Quotient

Appendix J

Visual Perceptual Test

Please cross out the word **rain** wherever you see it.

Participant number	
Aphasia Quotient	

cat

rain

water

milk

cloud

dog

book

rain

jump

red

Appendix K

Written-choice Communication Strategy Screener

Participant number	
Aphasia Quotient	

1. You wash with…

coffee

banana

soap

toilet

2. You write with a…

pen

toe

apple

dog

3. You sit on a…

toothbrush

chair

orange

cat

4. You tell time with a…

baby

road

watch

house

Appendix L

Narratives

Each narrative will be read by the research to the participant a total of two times.

Narrative 1: Lost Dog (0% condition)

After weeding his garden, John left the gate open. When he let his dog out, the dog ran through the gate and down the street. After waiting a few days, John checked for his dog at the animal shelter. A worker said a family had come in, fallen in love with the dog, and taken him home. Not wanting to sadden the other family, John asked the worker where to look for a new dog.

Narrative 2: Out of petrol (50% condition)

While driving in a rural area, Mark ran out of petrol. He waited in his car, hoping someone would come by to help. After an hour, he gave up and started walking to the nearest town ten kilometres away. Just then, a farmer drove by in a bakkie but refused to give Mark a ride, because he was going the other way. He scolded Mark for not planning ahead when driving in a rural area.

Narrative 3: Lost Purse (100% condition)

While shopping, Mrs White's purse fell from her handbag without her seeing it. When she got to the cashier, she had no way to pay for her groceries. The cashier reported seeing a little girl pick up a purse and leave. Mrs White was mad that the cashier had not stopped the little girl, and she yelled at him. She left outraged, thinking about all the people she would have to contact about the theft.

Appendix M

Expert Panel Questionnaire

Dear colleague

Thank you for agreeing to be a part of my expert panel. Your time and expertise are greatly appreciated. Please complete the following questionnaire. There are no right or wrong answers; your opinion is important, and all input will be appreciated. Please circle one of the numbers to indicate your response and add any comments or suggestions.

Please take the time to read one of the narratives for the study, and then answer the questions regarding the suggested changes:

While driving in the country, Mark ran out of **gas**. He waited in his car, hoping someone would come by to help. After about an hour, he gave up and started walking to the nearest town ten **miles** away. Just then, a farmer drove by in a **pickup truck** but refused to give Mark a ride, because he was going the other way. He scolded Mark for not planning ahead when driving in the **country**.

Changes	Rating	Comment/suggestions
Country -> rural area	1 = The new word is not suitable at all. 2 = The new word is a little bit suitable. 3 = The new word is completely suitable.	
Gas -> petrol	1 = The new word is not suitable at all. 2 = The new word is a little bit suitable. 3 = The new word is completely suitable.	
Miles -> kilometres	1 = The new word is not suitable at all. 2 = The new word is a little bit suitable. 3 = The new word is completely suitable.	
Pickup truck -> bakkie	1 = The new word is not suitable at all. 2 = The new word is a little bit suitable. 3 = The new word is completely suitable.	

Appendix N

Content unit list

Referenced and supported during reading of narrative

	Narrative 2	**Narrative 3**
1	Driving	Shopping
2	Rural area	Mrs White
3	Mark	Purse
4	Ran out of petrol	Fell
5	He	Handbag
6	Waited	Without seeing
7	Car	She
8	Hoping	Got
9	Someone	Cashier
10	Come	She
11	Help	No way to pay
12	After	Groceries
13	Hour	Cashier
14	He	Reported
15	Up	Seeing
16	Walking	Little
17	Nearest	Girl
18	Town	Pick up
19	Ten	Purse
20	Kilometres	Leave
21	Away	Mrs White
22	Farmer	Mad
23	Drove	Cashier
24	Bakkie	Not stopped
25	Refused	Little
26	Mark	Girl
27	Ride	She
28	He	Yelled
29	Going	Him
30	Other way	She
31	He	Left
32	scolded	Outraged
33	Mark	Thinking
34	Not planning	All the people
35	Ahead	She
36	Driving	Contact
37	Rural area	Theft

Appendix O

Pilot study questionnaire for person with aphasia/significant other

Thank you for helping me with my study. I have a few questions about your experiences today so that I can know if I need to change anything.

1. How easy/difficult was it for you to understand the information and consent letter? (PWA). Is there something that I should change or explain better?

---

2. How easy/difficult was it for you to understand the information and consent letter? (Significant other). Is there something that I should change or explain better?

---

3. How did you find these activities? (WAB-R, visual perceptual skills screening test and the Written-choice Communication Strategy screening test)? Is there something that I should change or explain better?

---

4. Did you have any problems with the words used in the stories?

---

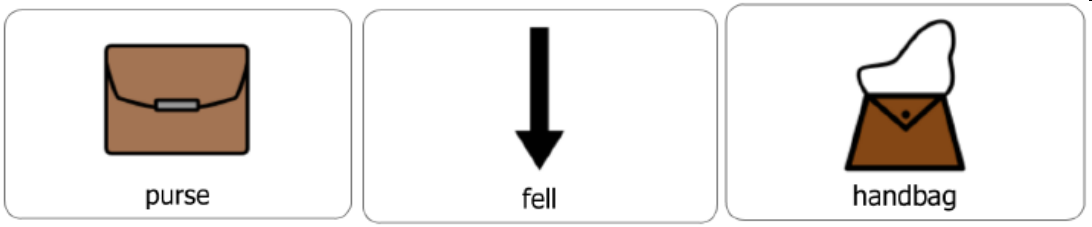
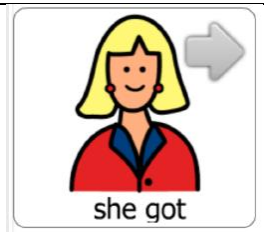
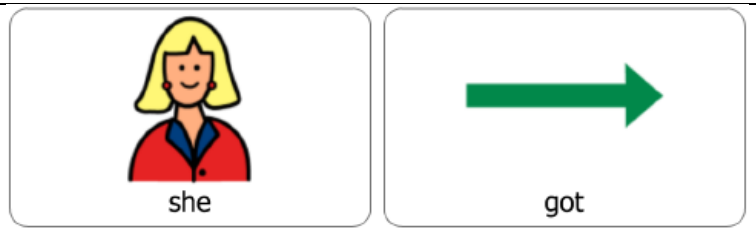
5. How easy/difficult did you find the questions? Did you have any problems with the words used in the questions?

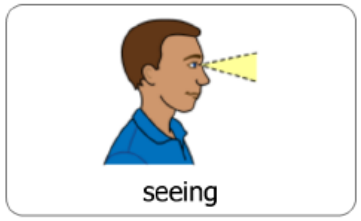
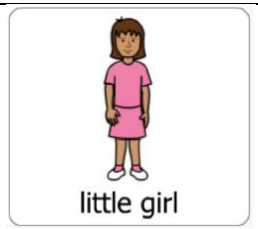
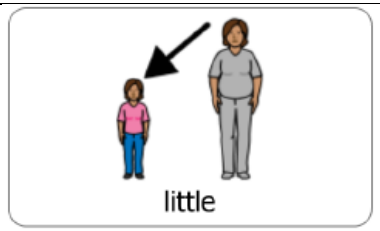
---

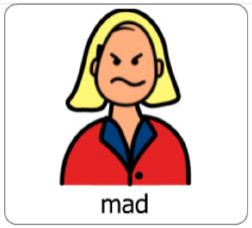
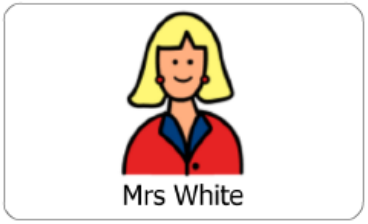
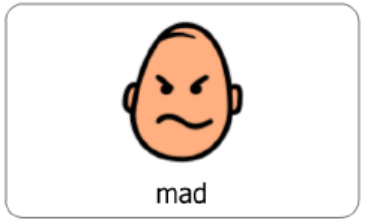
6. How did you find the length of time it took to do everything?

---

7. Please look at the following pictures and show me which option do you like better and why. Please also let me know if there were any of the other pictures in the study that you had a problem with.

Which one of the images looks most like:		
OPTION A: One image	OPTION B: More than one image	Reason for choice
“PURSE FELL FROM HANDBAG”		
 Purse fell from handbag		
“SHE GOT” [to the cashier]		
		

[he] “REPORTED SEEING”		
	 	
“LITTLE GIRL”		
	 	
“PICK UP THE PURSE”		
	 	

“MRS WHITE WAS MAD”		
	 	
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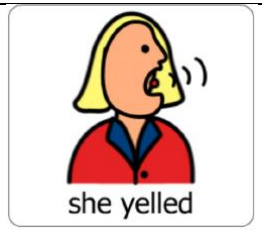
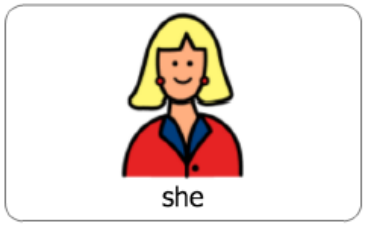
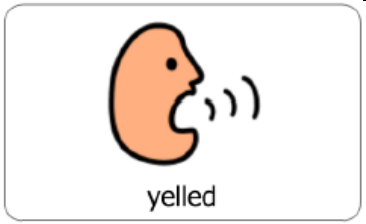
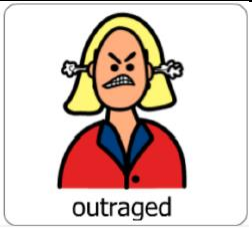
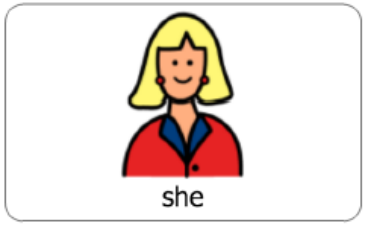
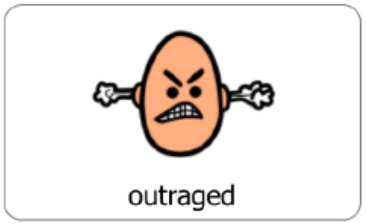
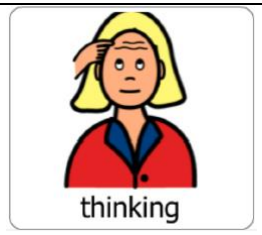
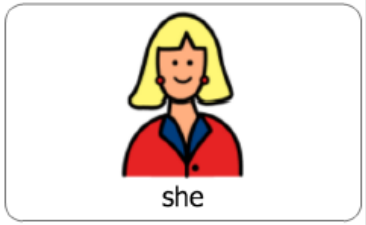
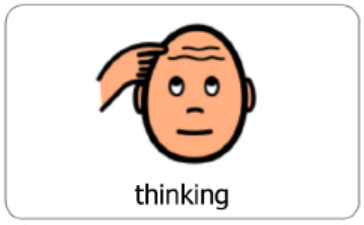
	 	
“SHE WAS OUTRAGED”		
	 	

“SHE WAS THINKING”		
	 	
Additional comments:		

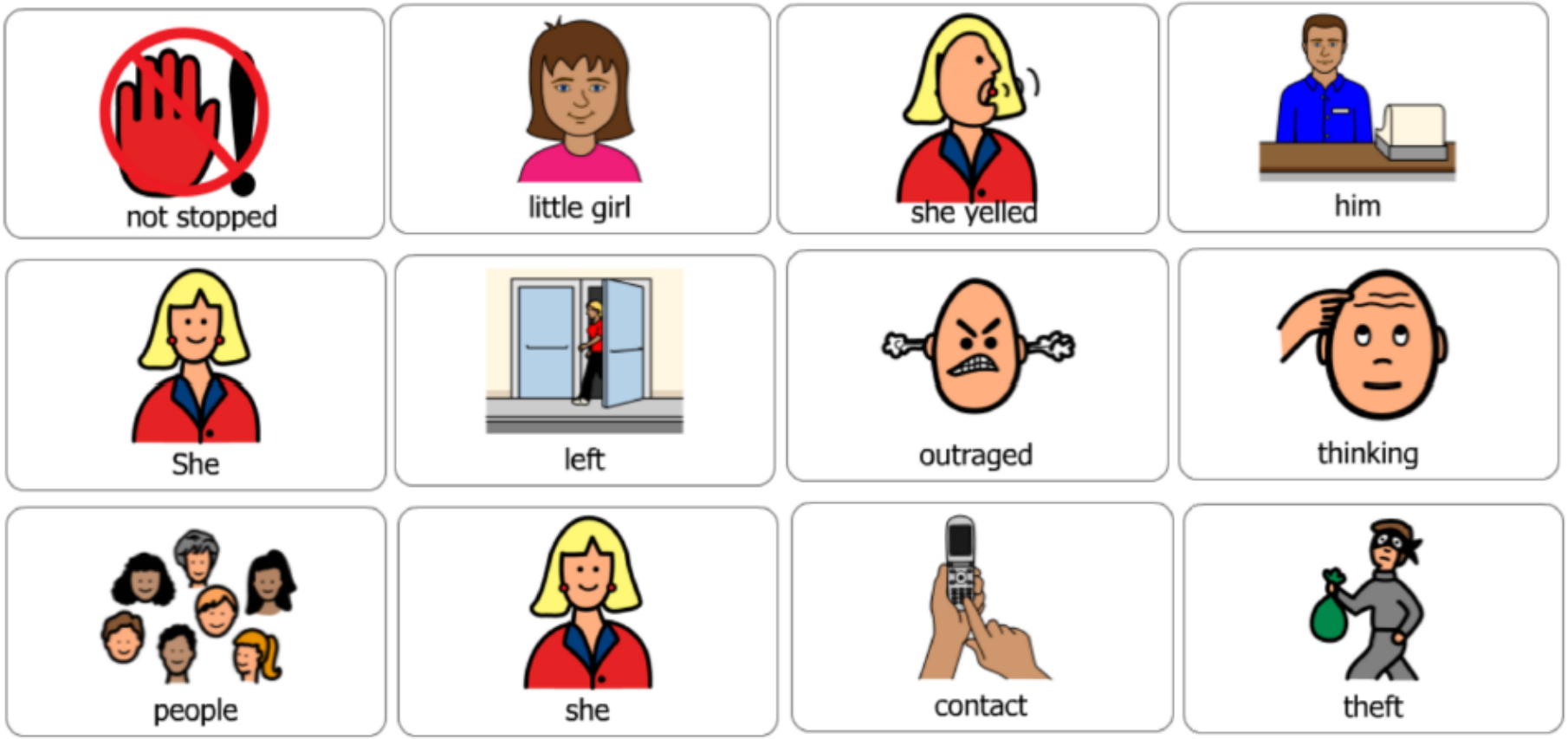
Appendix P

PCS Images

Narrative 2 : Out of Petrol (50% condition)


scolded
not planning
ahead

Narrative 3: Lost Purse (100% condition)


not stopped
little girl
she yelled
him
She
left
outraged
thinking
people
she
contact
theft

Appendix Q

High-Context Photographs

These photographs will be shown to participants as pre- and during-task stimulation

Narrative 1: Lost Dog (0% condition)

Narrative 2: Out of Petrol (50% condition)

Narrative 3: Lost Purse (100% condition)

Appendix R

Comprehension Items

Participant number
Aphasia Quotient

LOST PURSE

1. The purse fell out of a

   a. backpack

   b. pocket

   c. handbag

   d. shopping bag

2. The woman’s name was

a. Mrs Wells

b. Mrs James

c. Mrs Wright

d. Mrs White

3. Mrs White discovered her purse was missing when she got to the

a. cashier

b. house

c. petrol station

d. car

4. Mrs White was in a

a. bookstore

b. grocery store

c. clothing store

d. pharmacy

5. After leaving the store, Mrs White will probably call her

a. neighbour

b. doctor

c. friend

d. bank

6. The purse was picked up by the

a. girl

b. cashier

c. boy

d. man

7. Mrs White’s money was

a. spent

b. hidden

c. returned

d. stolen

8. The cashier was

a. observant

b. grumpy

c. efficient

d. friendly

9. Mrs White and the cashier

a. waited

b. argued

c. searched

d. left

10. Mrs White learnt some people are

a. dishonest

b. generous

c. patient

d. forgetful

11. The cashier gave Mrs White

a. information

b. change

c. advice

d. coupon

12. After talking to the cashier, Mrs White felt

a. confused

b. relieved

c. angry

d. thankful

13. The person who saw the theft was a/an

a. police officer

b. employee

c. customer

d. little girl

14. Mrs White thought the cashier was

a. helpful

b. cheerful

c. lying

d. irresponsible

15. Mrs White could not pay for her

a. clothes

b. groceries

c. books

d. coffee

Number of correct responses	

LOST DOG

Participant number	
Aphasia Quotient	

1. The man’s name was

a. Joe

b. Don

c. David

d. John

2. John was working in the

a. garage

b. house

c. park

d. garden

3. John learnt it was important to be

a. friendly

b. polite

c. hard-working

d. prompt

4. Regarding others, John was

a. considerate

b. outgoing

c. sarcastic

d. thoughtless

5. John learnt a consequence of being

a. trusting

b. deceitful

c. impatient

d. irresponsible

6. John looked for his dog in the

a. paper

b. park

c. animal shelter

d. town

7. Later, John will make an appointment with a

a. gardener

b. veterinarian

c. handyman

d. mechanic

8. At the end of the story, the dog was probably

a. happy

b. dead

c. returned

d. hungry

9. Before going to the animal shelter, John waited a few

a. days

b. weeks

c. minutes

d. hours

10. At the end of the story, John gets a new

a. dog

b. cat

c. fence

d. gate

11. The dog was adopted by a

a. little boy

b. old lady

c. family

d. worker

12. John’s dog escaped by running

a. door

b. garage

c. hole

d. gate

13. To find a new dog, John asked the

a. family

b. worker

c. neighbour

d. veterinarian

14. The dog ran into the

a. street

b. field

c. ditch

d. park

15. When working in his garden, John was

a. watering

b. planting

c. weeding

d. pruning

Number of correct responses	

Participant number
Aphasia Quotient

OUT OF PETROL

1. The man’s name was

a. Mark

b. Matt

c. Tom

d. Hank

2. Mark had a problem with his

a. car

b. camper

c. truck

d. mower

3. When he realized his problem, Mark

a. panicked

b. laughed

c. waited

d. swore

4. While waiting, Mark felt

a. frustrated

b. vulnerable

c. thirsty

d. tired

5. Mark stayed in a

a. house

b. diner

c. town

d. car

6. Mark was driving in the

a. rural area

b. snow

c. city

d. rain

7. The person who stopped was a

a. friend

b. mechanic

c. policeman

d. farmer

8. When the farmer stopped, Mark was

a. hopeful

b. angry

c. dirty

d. asleep

9. The farmer was

a. unkind

b. unhelpful

c. noisy

d. distracted

10. The farmer made Mark feel

a. foolish

b. better

c. smart

d. sad

11. After talking to the farmer, Mark will probably

a. walk

b. eat

c. ride

d. call

12. The farmer refused to give Mark

a. money

b. petrol

c. a ride

d. food

13. Before walking, Mark waited

a. 2 hours

b. 1 hour

c. 30 minutes

d. 15 minutes

14. The farmer was driving a

a. car

b. tractor

c. bakkie

d. combine

15. The nearest petrol station was a distance of

a. 1 kilometre

b. 2 kilometres

c. 10 kilometres

d. 20 kilometres

Number of correct responses	

Appendix S

Procedural script

PROCEDURE	SCRIPT	TICK IF COMPLETED
Greet person with aphasia and their significant other	"Hallo …..... and ..... It is nice to meet you."	
Introduce yourself	"My name is Jacqueline and I am a speech therapist. I am busy with a Master's degree in AAC."	
Explain purpose, nature and duration of study	"This study is investigating how to help people with aphasia, specifically Wernicke's aphasia, following a stroke understand better. We will start with pre-experimental tasks and then do the experiment. I will take about one and a half hours and there is only one meeting."	
Explain information part of consent forms	"First we will go through this information letter to explain more about the study." Go through letter.	
Sign consent forms	"Now we will go through the consent forms. I will ask you a question and you must say yes or no. If you say yes to the last question, please sign your name."	
Complete biographical questionnaire	"I will now ask you some questions about yourself. Your significant other may help you to complete it."	
Pre-experimental procedures		
Administration of the WAB-R aphasia quotient	"We will now do a short assessment to see what kind of language difficulties you	

	have. I will explain the instructions as we go along. It does not matter if you get some of the questions wrong. Your significant other may not help you with this."	
Visual perceptual skills screening test	"Now I want you to find the word *rain* amongst the other words. Please cross it out whenever you find it."	
Written-choice Communication Strategy screening test	"Please complete these statements by pointing to the right answer. I will read each question twice."	
Thank participant	"Thank you. We are now finished with the pre-experimental tasks."	
Offer a comfort break	"We can now take a short 10-minute break if you like. Then we will start with experimental tasks."	
Results:		
Switch on video recorder		
Inform the person with aphasia that we are starting with the experimental task	"We will now be starting with the experimental tasks."	
Provide him/her with instructions	"I will record you while I read some stories and ask you questions about the stories. I will read each story twice, and then we will need to answer questions about the story. Listen carefully and take your time to answer."	

Pre-task stimulation: Place corresponding high-context photograph and PCS images in front of participant before reading of narrative	"Please take some time to look at these pictures. They will help you to understand the story."	
Provide participant one minute to look at the pictures		
Condition 1 (0% AI-PP)		
Read the narrative twice to the participant. Both the high and no-context PCS images remain in front of the participant during the reading of the narrative	"I will now read you the story."	
Remove the high-context image before reading out the comprehension items and clozed options		
Written-choice Communication Strategy: Read comprehension items twice while simultaneously pointing to each of the response options	"I will now ask you some questions about the story."	
Provide participants with two minutes to respond to each question	"Please show me your answer by pointing the word."	
After each answer, repeat the participant's choice and circle it		
Feedback after questions 1, 5 and 9	"You are doing/trying well!"	

Feedback after question 12	"We are almost done."	
Feedback after question 14	"Only one more question to go."	
Remove comprehension items, high-context photographs and no-context PCS images after completion of all 15 comprehension items		
Offer comfort break (unless it the last condition)	"We can now take a short 5-minute break if you like. After that we will start with the next task."	
Condition 2 (50% AI-PP)		
Read the narrative twice to the participant while simultaneously pointing to the corresponding no-context PCS images. Both the high- and no-context PCS images remain in front of the participant during the reading of the narrative		
Remove the high-context image before reading out the comprehension items and clozed options		
Written-choice Communication Strategy: Read comprehension items twice while simultaneously pointing to each of the response options	"I will now ask you some questions about the story."	
Provide participants with two minutes to respond to each question	"Please show me your answer by pointing to the word."	

After each answer, repeat the participant's choice and circle it		
Feedback after questions 1, 5 and 9	"You are doing/trying well!"	
Feedback after question 12	"We are almost done."	
Feedback after question 14	"Only one more question to go."	
Remove comprehension items, high-context photographs and no-context PCS images after completion of all 15 comprehension items		
Offer comfort break (unless it the last condition)	"We can now take a short 5-minute break if you like. After that we will start with the next task."	
Condition 3 (100% AI-PP)		
Read the narrative twice to the participant while simultaneously pointing to the corresponding no-context PCS images. Both the high- and no-context PCS images remain in front of the participant during the reading of the narrative		
Remove the high-context image before reading out the comprehension items and clozed options		
Written-choice Communication Strategy: Read comprehension items twice	"I will now ask you some questions about the story."	

while simultaneously pointing to each of the response options		
Provide participants with two minutes to respond to each question	"Please show me your answer by pointing the word."	
After each answer, repeat the participant's choice and circle it		
Feedback after questions 1, 5 and 9	"You are doing/trying well!"	
Feedback after question 12	"We are almost done."	
Feedback after question 14	"Only one more question to go."	
Remove comprehension items, high-context photographs and no-context PCS images after completion of all 15 comprehension items		
Offer comfort break (unless it is the last condition)	"We can now take a short 15-minute break if you like. After that we will start with the next task."	
Closing off		
Thank participant	"We are now done. Thank you for your time."	
Switch off video camera		

Appendix T

Feedback pamphlet

Easy-to-read version of

The effect of frequency of picture support on the understanding of stories for persons with Wernicke's aphasia

Jacqueline Leuvennink & **Professor Shakila Dada**

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UNIVERSITEIT VAN PRETORIA
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YUNIBESITHI YA PRETORIA

Why did we do the study?

People with Wernicke's aphasia often struggle with understanding language. This may lead to people feeling frustrated. We believe that supporting stories with pictures for people with Wernicke's aphasia, will improve their understanding of the stories.

What did we want to find out?

Picture support refers to the simultaneous reading of a story and pointing to pictures to help in understanding the story. This study wanted to find out what the effect of different amounts of picture support would have on the understanding of stories for people with Wernicke's aphasia.

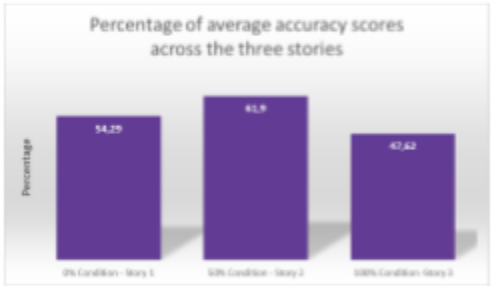
Frequency	Sentence	Support
0%	She left outraged, thinking of all the people she would have to contact about the theft	No pictures
50%	She **left outraged**, thinking of all the people she would have to **contact** about the **theft**	
100%	**She left outraged, thinking** of all the **people she** would have to **contact** about the **theft**	

How did we do the study?

Seven participants with Wernicke's aphasia participated. The participants listened to three stories.
In the first story no pictures were shown or pointed to when telling the story.
In the second story, 50% of the words relating to the story were supported by pictures that were pointed to when telling the story.
In the third story 100% of the words relating to the story were supported by pictures that were pointed to.
The persons with Wernicke's aphasia then had to answer 10 factual and 5 inferential questions based on each story.

What did we find?

The majority of the participants (4 out of 7) had more accurate scores when 50% of the words relating to the story were supported by pictures, than when 0 or 100% of the words relating to the story were supported by pictures.



What does this mean?

This means that simultaneously reading a story and pointing to pictures for support, seem to improve the understanding of stories for some persons with Wernicke's aphasia. However, the amount of the provided pictures is an important factor influencing understanding. Providing pictures is more beneficial than providing no pictures, and providing half the pictures is more beneficial than providing all the pictures, when supporting understanding of stories for some people with Wernicke's aphasia.

A special word of thanks goes to the participants and organizations who participated in this study. This study was supported by a grant-holder linked bursary from The Andrew W. Mellon Foundation. Opinions expressed in this report and conclusions arrived at are those of the authors and not attributed to the funders.

THE ANDREW W. MELLON FOUNDATION

Appendix U

Declaration of originality

UNIVERSITY OF PRETORIA

DECLARATION OF ORIGINALITY

This document must be signed and submitted with every

essay, report, project, assignment, dissertation and/or thesis.

Full names of student: Jacqueline Lisinda Leuvennink

Student number: 17352194

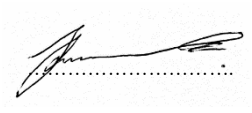
Declaration

1. I understand what plagiarism is and am aware of the University's policy in this regard.

2. I declare that this mini-dissertation is my own original work. Where other people's work has been used (either from a printed source, Internet or any other source), this has been properly acknowledged and referenced in accordance with departmental requirements.

3. I have not used work previously produced by another student or any other person to hand in as my own.

4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

SIGNATURE OF STUDENT: 

SIGNATURE OF SUPERVISOR: ……

Appendix V

Declaration from language editor

Letter KRAFT
LANGUAGE SERVICES
Clear . Concise . Correct

Editing Declaration

Lené Kraft
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To whom it may concern 19 June 2019

I hereby declare that I am a professional editor and have edited and proofread the following research:

The effect of frequency of augmented input on the auditory comprehension of narratives for persons with Wernicke's aphasia
by
Jacqueline Lisinda Leuvennink

As a professional editor with an English major obtained from the University of Pretoria in 2003, I am also a Full Member of the Professional Editors' Guild and a member of SATI (membership number 1002503).

Yours sincerely

Mrs Lené Kraft