The effect of augmented input on the auditory comprehension of narratives for persons with chronic aphasia

by

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ABSTRACT

Background: Augmented input (AI) refers to any visual or linguistic strategy used by communication partners to increase the message comprehension of a person with aphasia. Previous research has focused on the type of AI, such as high versus low context images and linguistic versus visual supports, that can be used to facilitate improved auditory and reading comprehension. The results of these studies have been varied. To date, researchers have not evaluated the frequency of AI required to improve auditory comprehension of persons with chronic aphasia.
Aims: The purpose of this study was to determine the effect of AI using no context Picture Communication Symbols™ (PCS) images, presented at a frequency of 70%, versus no AI on the accuracy of auditory comprehension of narratives for persons with chronic aphasia.
Methods and procedures: A total of 12 participants with chronic aphasia listened to two narratives, one in each of the conditions. Auditory comprehension was measured by assessing participants' accuracy in responding to 15 multiple choice cloze-type statements related to the narratives.
Results: Of the 12 participants, 7 participants (58.33%) gave more accurate responses to comprehension items in the AI condition, 4 participants (33.33%) gave more accurate responses in the no AI condition and 1 participant scored the same in both the conditions.
Conclusion: No context Picture Communication Symbols™ (PCS) images used as AI improved the accuracy of responses to comprehension items based on narratives for some persons with chronic aphasia. Continued research is necessary in order to determine what forms and frequency of AI will lead to improved auditory comprehension for persons with aphasia.

Keywords: AAC, Aphasia, Augmented input, Auditory comprehension, Communication strategies, Stroke.

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1. Research Topic

The effect of augmented input on the auditory comprehension of spoken narratives by persons with chronic aphasia.

2. Problem Statement and Literature Review

The communication needs of persons with aphasia are wide-ranging, and often complex (Jacobs, Drew, Ogletree, & Pierce, 2004). The challenge of understanding and conveying messages faced by persons with aphasia inhibits their participation in communicative exchanges with those around them (Beukelman, Hux, Dietz, McKelvey, & Weissling, 2015), and these challenges may persist despite intensive therapy (LaPointe, 2011).

2.1 Aphasia and AAC

Aphasia is a communication impairment that affects a person's ability to understand and use symbolic language (Hilari, Needle, & Harrison, 2012; Jacobs et al., 2004). Aphasia can be the result of any type of brain injury; however, it is predominately acquired as a result of a cerebral vascular accident (CVA) to the left cerebral hemisphere (Garrett & Lasker, 2005; Koul & Corwin, 2011).

In South Africa, approximately 75 000 new strokes occurred in 2008 (Bertram, Katzenellenbogen, Vos, Bradshaw & Hofman, 2013). In 2007 there were 350 000 people living with strokes in South Africa, of which 35% had moderate to severe disability as a result (Bertram et al., 2013). Approximately 1 in every 275 adults in the United States of America has aphasia (Beukelman, Fager, Ball & Dietz, 2007). Of those persons with aphasia, up to 40% have aphasia as a chronic and severe language impairment (Beukelman et al., 2007), and are therefore often unable to meet their communication needs through speech alone (Lasker & Garrett, 2006). Owing to the high prevalence of stroke in South Africa, it can be assumed that the number of persons with aphasia following stroke is also high in this country (Barratt, Khoza-Shangase & Msimang, 2012).

Persons with chronic aphasia face a number of communication challenges, that include "comprehending what others say, creating ideas, retrieving words and sentence structures, or executing the motor movements to speak" (Garrett & Lasker, 2005, p. 405). These communication challenges not only inhibit the persons'

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participation in communicative exchanges with those around them (Beukelman et al., 2015; Carlsson, Hartelius, & Saldert, 2014), but also their ability to participate in desired vocational roles, and reduces involvement in decision making (Wallace & Bradshaw, 2011).

Augmentative and alternative communication (AAC) may offer opportunities for enhanced communication for persons with aphasia (Beukelman et al., 2015; Lasker & Garrett, 2006). AAC "refers to an area of research, clinical, and educational practice. AAC involves attempts to study, and when necessary compensate for temporary or permanent impairments, activity limitations, and participation restrictions of individuals with severe disorders of speech-language production and/or comprehension, including spoken and written modes of communication" (ASHA, 2005, p. 1). AAC makes use of a collection of both high- and low-technology approaches and supports that are designed to supplement spoken language, or impaired language skills (Wilkinson & Henning, 2007), enhance the understanding of persons with auditory comprehension deficits, and offer a means for persons with severe communication impairments to participate more independently in their life activities (Garrett & Lasker, 2005).

Without access to successful and effective communication, persons with communication impairments, such as aphasia, live their lives with limited means to express their needs and wants, develop social closeness and relationships, share and receive information with others, have an influence on their environments, fulfill social etiquette routines, and participate fully in society (Beukelman & Mirenda, 2013; Blackstone, Williams, & Wilkins, 2007; Light, 1988).

Successful communication can result in meaningful improvements in quality of life for persons with aphasia, and may result in reducing the risk of avoidance and social isolation (Wallace & Bradshaw, 2011). Not only does effective communication positively impact the quality of life for persons with aphasia and their significant others, but it is also critical for the delivery of high quality healthcare services, and has the potential to improve patient satisfaction and health outcomes (Morris, Clayman, Peters, Leppin & LeBlanc, 2015).

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2.2 Facilitating improved comprehension with AI

The research on communication for persons with aphasia has predominately focused on improving expressive language skills, and little attention has focused on improving comprehension skills (Beukelman et al., 2007, Jacobs et al., 2004; Koul & Corwin, 2011; Wood, Lasker, Siegel-Causey, Beukelman & Ball, 1998). Impairments in auditory comprehension impose distinctive challenges on persons with aphasia, and can contribute towards feelings of frustration and increased dependence on caregivers (Wallace, Dietz, Hux, & Weissling, 2012). These individuals also have poorer rehabilitation prognoses for other types of therapy in comparison to individuals without auditory comprehension difficulties (Paolucci et al., 2005). As a result, persons with aphasia may require communication supports to foster increased comprehension in order to participate more effectively in communicative interactions (Wallace et al., 2012).

Augmented input (AI) is one such communication support, and refers to a method of enhancing understanding using any form of linguistic or visual strategy. AI is employed by the communication partner to increase the message comprehension of a person with aphasia by increasing the saliency of the information presented (Garrett & Lasker, 2005; Wallace et al., 2012; Wood et al., 1998). When using AI, the incoming communicative message is augmented by simultaneously pointing to and labeling key symbols on the AAC device (Dada & Alant, 2009).

The impairments associated with aphasia affect all aspects of symbolic language processing, and therefore the simple substitution of language symbols for alternative symbols is insufficient to facilitate effective communication (Koul & Harding, 1998). To avoid communication shortfalls, clinicians working with persons with aphasia have begun using AI to facilitate the communication attempts of persons with aphasia (McKelvey et al., 2010).

Linguistic strategies used as AI comprise of auditory or visually presented information, such as the writing of keywords or headings, written choice strategy, and prosodic emphasis, to support comprehension (Dietz, Knollman-Porter, Hux, Toth & Brown, 2014; Garrett & Beukelman, 1992; Griffith et al., 2014; Wallace et al., 2012). Visual strategies include gesturing, or visuo-graphic images such as line drawings or photographs (Griffith, Dietz & Weissling, 2014; Wallace et al., 2012). These images could have high, low or no contextualization, as well as differ with regards to the level

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of personalization (Wallace et al., 2012). High context photographs are visuo-graphic images that “depict situations, places or experiences that clearly represent relationships and interactions among important people or objects” (Hux, Buechter, Wallace, & Weissling, 2010, p. 644), while no context images depict isolated people or objects against a neutral background (Wallace et al., 2012). Low context images are similar to high context images in that they include a natural environment; however, the difference is based on the presence or absence of interaction between the subject of the image and the environment. If there is no interaction, these images would be considered low context (Wallace et al., 2012).

Individuals without communication impairments make use of AI strategies to increase the salience of the messages they wish to convey, thus, applying similar strategies to augment the comprehension of persons with aphasia seems logical (Dietz et al., 2014; Wallace et al., 2012). The use of AI is believed to provide information redundancy, thereby reducing the cognitive load required to do a task, as well as activating prior stored knowledge, to improve auditory comprehension (Wallace et al., 2012). AI is believed to provide the context necessary for persons with aphasia to extract essential information to successfully comprehend auditory tasks (Wallace et al., 2012).

Research within the paediatric field has identified that AI has been successful in improving both comprehension and production across spoken and augmented modalities for individuals who use AAC (Drager et al., 2006; Harris & Reichle, 2004). Only one study investigated the amount of AI needed for improved comprehension for children with little or no functional speech (LNFS). The study by Dada and Alant (2009) identified that AI provided at a frequency of 70% improved the comprehension of 24 vocabulary items for children with LNFS. Frequency refers to the number of times AI is provided (Dada & Alant, 2009). This means that the communication partner points to related images on the AAC device at the same time as verbally saying the word that the image represents 70% of the time (Dada & Alant, 2009). No research to date has been conducted on the amount of AI needed for improved comprehension for persons with aphasia.

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2.3 Linguistic forms of AI

The use of linguistic supports has been researched in an attempt to understand their ability to facilitate improved auditory and reading comprehension (Brennan, Worrall, & McKenna, 2005; Dietz, Ball, & Griffith, 2011; Dietz et al., 2014; Garrett & Beukelman, 1992; Garrett & Beukelman, 1995). Garrett and Beukelman (1992) developed a technique called written choice strategy, to assist partners to communicate with persons with severe aphasia about topics of interest. This technique provides an alternative modality to circumvent the need for speech output, whereby the person with aphasia has to point to a choice of written words in order to communicate (Garrett & Beukelman, 1992).

Written choice strategy is used by communication partners and persons with aphasia by initially selecting a topic of mutual interest. The communication partner then verbally asks a question to initiate the conversation. If the person with aphasia is unable to answer, the communication partner writes down and reads aloud two to five options that could potentially answer the question. The person with aphasia is then encouraged to point to the answer, and the communication partner verbally reinforces the response (Garrett & Beukelman, 1992). It is believed that the visually presented information in the form of written word choices, in conjunction with the auditory information, will assist with the facilitation of improved communication (Garrett & Beukelman, 1992).

In a later study by Garrett and Beukelman (1995), the quantity, comprehensibility and accuracy of information transfer between a person with severe, chronic aphasia and a communication partner was compared using written choice strategy and no strategy (i.e. unsupported communication). The participant in this study was a 66-year-old male who had survived a stroke one year and five months prior to the experiment. He had received an extensive period of rehabilitation; however, he had not regained functional communication and continued to present with severe global aphasia. The results of this study indicated that the use of written choice strategy resulted in more communicative exchanges per topic, increased comprehensibility of responses, and more accurate responses. These favorable results suggest that the participant understood the meaning of the choices presented using AI in the form of written choice strategy (Garrett & Beukelman, 1995).

In more recent studies that have made use of linguistic supports to improve reading comprehension, results have been varied. Aphasia-friendly text principles,

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which include using large text, large amounts of white space, simple words and sentences, and include relevant pictures, have been found to improve the reading comprehension of printed health education materials for persons with aphasia (Rose, Worrall & McKenna, 2003). Furthermore, research by Brennan and colleagues (2005), which aimed to explore the effects of aphasia-friendly formats on reading comprehension of people with aphasia, as well as investigate if each single aspect of aphasia-friendly formatting used in isolation improved reading comprehension, confirmed that people with aphasia comprehend significantly more aphasia-friendly paragraphs than control paragraphs. Although the persons with aphasia comprehended significantly more paragraphs with simplified vocabulary, large print, and large white space; no significant difference was found between the paragraphs with pictures and the control paragraphs (Brennan et al., 2005).

The results of the above-mentioned study by Brennan et al. (2005) are in contrast to the study by Dietz et al. (2014), which aimed to document the effects of (a) no supports, (b) visual supports in the form of a high-context photograph, and (c) linguistic supports in the forms of (i) keywords and (ii) headings, on the reading comprehension of persons with aphasia. In this study, participants were required to answer comprehension items, which consisted of a set of 15 cloze-type statements, each with four possible answers, which corresponded to each written story. The accuracy of responses to comprehension items was compared, and data analysis showed a significant difference between the four conditions. Post hoc analysis revealed that the participants in the study performed significantly better on the comprehension items with the visual supports than with the keyword supports (Dietz et al., 2014). Comparisons between the other conditions indicated no significant differences (Dietz et al., 2014).

It is clear from these studies that research that makes use of linguistic supports to facilitate auditory (Garrett & Beukelman, 1995) and reading comprehension (Brennan et al., 2005; Dietz et al., 2014; Rose et al., 2003) for people with aphasia has produced mixed results, and there is a need for continued investigation.

2.4 Visual forms of AI

Research regarding the effectiveness of different forms of visual AI has also produced varied results (Dietz, Hux, McKelvey, Beukelman & Weissling, 2009; McKelvey, Hux, Dietz, & Beukelman, 2010; Wallace et al., 2012; Wallace et al., 2014).

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However; despite the non-significant findings of some studies, recent research suggests that high context photographs improve both reading and auditory comprehension for some persons with aphasia (Dietz et al., 2014; McKelvey et al., 2010; Wallace et al., 2014).

The belief that high context photographs improve comprehension for persons with aphasia is based on the notion that these images lessen the resource allocation and working memory demands placed on these individuals, as the information is contextually rich (Wallace et al., 2012). Images with little contextual information necessitate the formation of additional content to explain or understand the associated event and relationship (Beukelman et al., 2015). High context images rely on visuo-cognitive abilities and autobiographical memory rather than linguistic processing skills as the foundation of message representation (Beukelman et al., 2015). These skills are usually preserved in persons with aphasia (Beukelman et al., 2015; McKelvey et al., 2010). High context images are believed to allow persons with aphasia to better understand the messages conveyed, as well as provide a basis for establishing a shared communication space between the individual and their communication partner (Beukelman et al., 2015).

Although some research suggests that high context images offer the greatest support for persons with aphasia (Beukelman et al., 2015; McKelvey et al., 2010); other research has found that persons with aphasia viewed photographs and line drawings to be equally helpful with reading comprehension (Rose, Worrall, Hickson, & Hoffman, 2011) and retelling narratives (Griffith et al., 2014).

With regards to no context images, Picture Communication Symbols™ (PCS) and Gus Communication Symbols™ (GCS) are two commercially available pictorial symbol sets that are used in AAC intervention (Tsai, 2013). The study conducted by Tsai (2013) aimed to investigate typical adults' preference between PCS and GCS frequently displayed on AAC devices. Although there was no significant difference between participants' preferences, a greater number of adults preferred PCS to GCS, and identifying referents of PCS images was found to be easier than identifying GCS images (Tsai, 2013).

There is no consensus in research about what forms of visual AI supports improve auditory and reading comprehension best. Interestingly, participants from the study conducted by Griffith et al. (2014) stated that they would like more than two types of images incorporated into the interface design. Combining and using various types

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of images for AI provides a method of constructing unique visuo-graphic materials, and may help persons with aphasia to varying degrees (Wallace et al., 2012). The use of multiple AI strategies during comprehension tasks may increase information redundancy, and reduce the cognitive load, thereby enabling the person with aphasia to better comprehend the information (Wallace et al. 2012). To date, no such research has been conducted.

2.5 Systematic search of AI intervention studies and aphasia

The aim of the systematic search was to identify studies that investigated different types of AI used to facilitate improved comprehension for persons with aphasia. The terms searched were "people with aphasia" OR "stroke" OR "CVA" AND "augmented input" OR "supports" AND "comprehension" OR "understanding". The databases searched included EBSCOhost, Medline, CINAHL and Health Source: Nursing/Academic Edition. Additional articles were found through hand searches conducted by the researcher from identified articles. The inclusion criteria was the following: (i) published in English, (ii) peer-reviewed, (iii) describing visual or linguistic strategies to facilitate improved auditory or reading comprehension, and (iv) for people with aphasia.

The results of the search based on the above-mentioned keywords and databases were as follows: 319 articles were identified by database search. The articles were screened at title level, resulting in 313 being excluded from the database search as they did not focus on any form of AI or support that aimed to facilitate improved comprehension for persons with aphasia. The six remaining articles from the database search were scanned at the abstract level. One article was removed, as it did not relate specifically to AI or other supports that facilitate improved comprehension for people with aphasia, leaving a total of five articles identified via the database search. A total of eight articles (five from database searches and three from hand searches) were reviewed and summarized in Table 1. The prisma diagram in Figure 1 graphically depicts the process.

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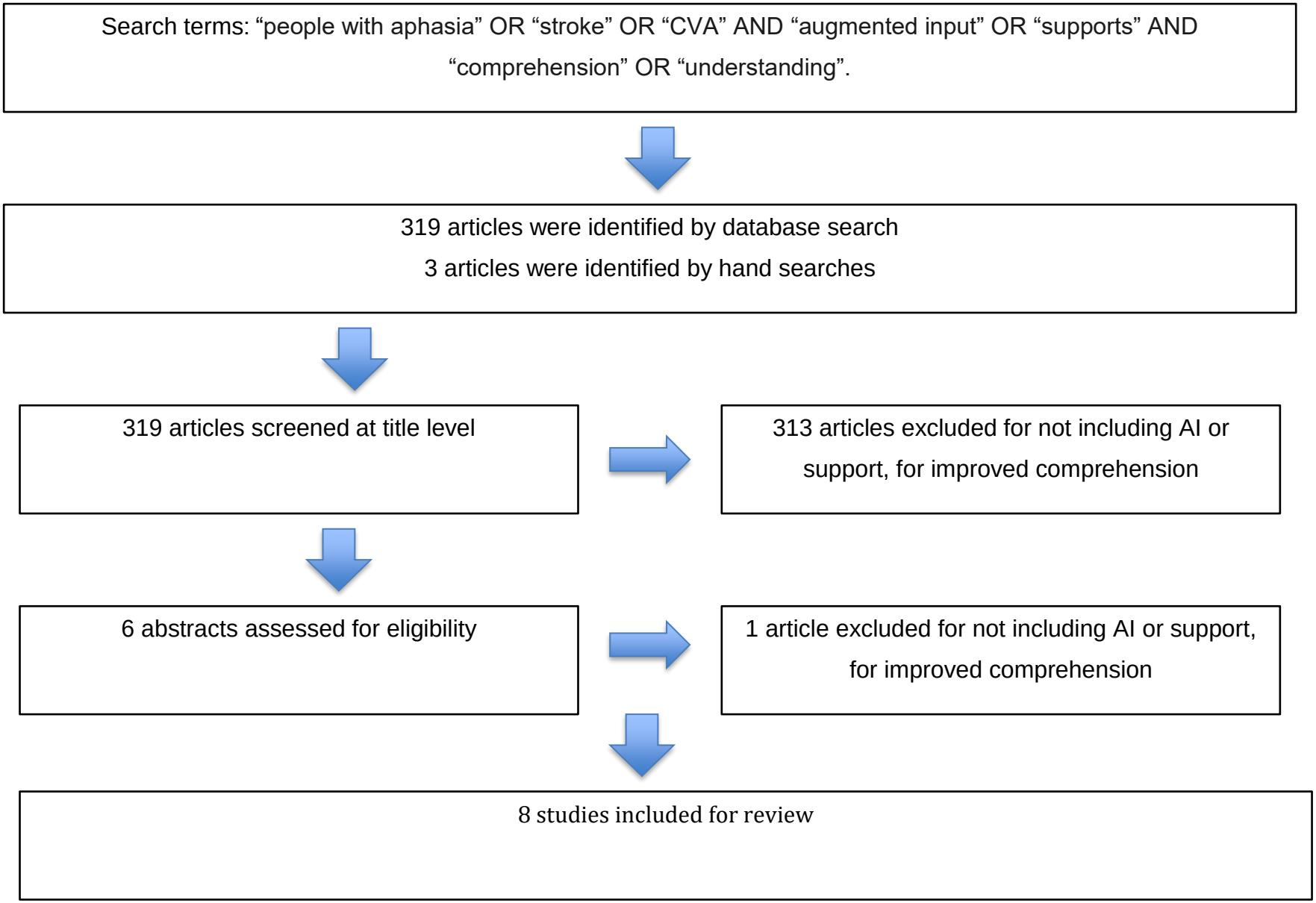

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Figure 1. Search process for studies included in systematic search.

Table 1

Systematic search of augmented input intervention studies

Authors	Year	Title	Aim	Participants	Procedure	Results	Implications for study
Brennan, Worrall & McKenna	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 people with aphasia. The study also aimed to investigate if each aspect of aphasia-friendly formatting used in isolation would	A total of 9 participants with mild to moderate chronic aphasia as a result of CVA	Participants' reading comprehension was measured using paragraphs that required the participant to choose from a possibility of 4, the best word or phrase to complete the final sentence of each paragraph. A battery of 90 paragraphs (30 of which were SRA reading grade equivalents 5, 30 at level 6 and	People with aphasia comprehended significantly more aphasia-friendly paragraphs than control paragraphs; they also comprehended significantly more paragraphs with simplified vocabulary and syntax, large print and increased white spaces. There was no significant	Aphasia-friendly formats increase the reading comprehension of people with aphasia; however, simply adding pictures (especially clipart) may not significantly improve reading comprehension of people with aphasia.

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Authors	Year	Title	Aim	Participants	Procedure	Results	Implications for study
			result in increased comprehension.		30 at level 7) were selected and divided into 6 sets: -Set 1: no modifications -Set 2:modified with simple vocabulary and syntax -Set 3: modified with large print -Set 4: modified with use of increased amounts of white space between lines of print -Set 5: modified with relevant pictures from clipart -Set 6: modified with all of the above (i.e., aphasia-friendly). Participants were asked to read each paragraph and select a word or phrase to complete the paragraph.	difference in comprehension when participants were presented with pictures.	
Dietz, Hux, McKelvey, Beukelman & Weissling	2009	Reading comprehension by people with chronic aphasia: A comparison of three levels of visuographic support	To explore the impact of 3 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	A total of 7 participants with chronic Broca's Aphasia and concomitant reading comprehension deficits secondary to a left CVA	3 narrative passages were developed by the researcher. Each narrative had 2 corresponding photographs for each of the experimental conditions (high context and low context photographs). During the experimental tasks the researcher placed the narrative, along with the 2 photographs, if applicable (i.e. not the no photograph condition) in front of the participant. Once the participant had indicated that they had finished reading, the researcher removed the passage and the photographs. The comprehension items were then presented to the participant. This included 9 questions with 4 response options each that related to both the concrete and inferential content within each narrative. Question sets were discontinued following three consecutive	Participants answered significantly more questions correctly in the high context condition in comparison to the low context condition; however, there was no significant difference between high context and no context conditions, or the low context and no context conditions. All participants perceived the high context photographs as helpful.	Visuo-graphic supports in the format of high context photographs positively influence the reading comprehension of people with chronic, non-fluent aphasia.

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Authors	Year	Title	Aim	Participants	Procedure	Results	Implications for study
					errors or if a participant expressed frustration.		
Dietz, Knollman-Porter, Hux, Toth, & Brown	2014	Supported Reading Comprehension for People with Aphasia: 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 people with aphasia.	A total of 17 participants (12 with non fluent aphasia and 5 with fluent aphasia) secondary to a left CVA The participants were at least 12 months post stroke at the time of the experiment.	Each participant was required to read each of the stories in each of the 4 conditions and respond to a set of 15 cloze statements, each with 4 possible response choices that corresponded to each story.	Participants showed significantly better reading comprehension when given photographs versus keywords.	Results indicate that participants with aphasia scored significantly higher comprehension scores given photographs as a form of visual support than they did given other reading support conditions; however, individual variability across participants was evident. Therefore further research is warranted.
Hux, Buechter, Wallace & Weissling	2010	Using visual scene displays to create a shared communication space for people with aphasia	To determine the effect of low-tech VSDs on the content and quality of communicative interactions between a person with aphasia and an unfamiliar communication partner.	1 individual with aphasia secondary to a CVA and 9 adults without communication challenges	The person with aphasia and the communication partners engaged in short one-on-one conversations about a specified topic in one of 3 conditions: shared VSDs, non-shared VSDs, and no VSDs. In the shared VSD condition both the person with aphasia and the communication partner had access to the VSD, in the non-shared VSD condition only the person with aphasia had access to the VSD, and in the no VSD condition neither the person with aphasia nor the communication partner had access to the VSD. Each interaction was 4.5 minutes long for each of the conditions and were presented in a systematically changing sequence across participants over 3 sessions. All sessions occurred over a 3-month period to control for learning effects.	The most conversational turns occurred in the shared VSD condition, communication partners produced utterances with higher conceptual complexity in the shared VSD condition, the person with aphasia conveyed the greatest number of content units in the shared VSD condition, and the person with aphasia perceived that information transfer, ease of conversational interaction and partner understanding were best in the shared VSD condition.	Low-tech VSDs have an impact on the manner and extent of to which a person with aphasia and their communication partner contribute towards conversational interactions involving information transfer.

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Authors	Year	Title	Aim	Participants	Procedure	Results	Implications for study
McKelvey, Hux, Dietz, & Beukelman	2010	Impact of personal relevance and contextualization on word-picture matching by people with aphasia	To determine the effect of personalization and contextualization of images on the preferences, and accuracy of word-picture matching for people with severe aphasia	A total of 8 participants (4 with severe Broca's Aphasia and 4 with severe Global aphasia) with aphasia secondary to a left CVA.	Each participant completed 2 experimental conditions during an individual session Preference task: Participants had to indicate their preference of visual stimuli that correspond to each of the target words. Accuracy task: Participants were required to identify which of the three images accurately represented the target word.	Participants (a) preferred using personally relevant, contextualized photographs rather than other types of photographs/images to represent target words and (b) performed more accurate word-picture matching when presented with target words associated with personally relevant, contextualized photographs than target words associated with non-contextualized or non-personalized photographs/ images.	Highlights the importance of using personally relevant high context images rather than no context iconic symbol systems to support communication.
Rose, Worrall, Hickson, & Hoffman	2011	Exploring the use of graphics in written health information for people with aphasia	To determine the effect of no images, line drawings and photographs on reading comprehension of printed educational materials (PEMs) related to health information for people with and without aphasia, was investigated. A graphic preference survey was also conducted to determine which type of graphic illustration (line drawing or photograph) people with aphasia and those without prefer.	A total of 22 participants with aphasia (20 with fluent aphasia and 2 with non-fluent aphasia). 15 significant others that were able to complete the reading comprehension task and graphic preference survey.	Participants were required to complete the reading comprehension task which was comprised of 15 paragraphs. The graphic preference survey comprised of 11 items using a 5 point Likert scale.	No significant difference in reading comprehension accuracy or time take across different conditions for people with and without aphasia. The preference test revealed that both participants with and without aphasia perceived that pictures help understanding.	Mixed results warrants the need for further investigation
Wallace, Dietz, Hux & Weissling	2012	Augmented input: The effect of visuographic supports on the auditory comprehension of	To determine the effect of visuo-graphic supports on the auditory comprehension of people with chronic aphasia	A total of 21 participants (16 with fluent aphasia, and 5 with non-fluent aphasia) with chronic aphasia	Participants were required to listen to four different narratives. Each of the narratives was presented to participants in one of the four conditions, which included no context photographs; low context	No significant difference in accuracy of comprehension scores across the four conditions	Mixed results warrants the need for further investigation.

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Authors	Year	Title	Aim	Participants	Procedure	Results	Implications for study
		people with chronic aphasia		secondary to left CVA.	drawings with embedded no context photographs; high context photographs and no visuo-graphic support. Participants were then required to respond to comprehension items based on the narratives.		
Wallace, Hux, Brown & Knollman-Porter	2014	High-context images: Comprehension of main, background, and inferential information by people with aphasia	To compare the accuracy and speed with which people with and without aphasia derive main action, background, and inferential information from high context images.	Participants included 20 people with aphasia secondary to single left-hemisphere CVA, and 20 age-matched control participants without aphasia.	Participants completed two sessions. The first session included administration of all screenings and standardised assessments. During the experimental condition participants had to selected a high-context image to match spoken sentences conveying main action, background, or inferential information. Participants listened to each audio recorded sentence presented twice, and selected the target image from a field of four.	Task performance by participants without aphasia was more accurate and faster than that of participants with aphasia regardless of sentence condition. Both groups were most accurate and fastest given sentences conveying main actions. The participants with aphasia 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.	Owing to the fact that participants with aphasia took about twice as long to respond on average as participants without aphasia highlights the need for ample processing time when interacting with people with aphasia. The results suggest that many people with aphasia can derive substantial information from high context images.

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2.6 Comparing the studies of visual and linguistic supports

Research using visual (Wallace et al., 2012; Wallace et al., 2014) and linguistic supports (Dietz et al., 2014; Rose et al., 2011) to aid comprehension for persons with aphasia has produced mixed results. This lack of consensus may be a result of the inconsistencies between the different studies. These variances between the studies are discussed in terms of (a) participant characteristics, (b) the different nature of the tasks, and (c) the presence or absence of pre-task stimulation (Dietz et al., 2014). These contrasting results highlight the need for continued investigation.

Participants

As previously mentioned, the various studies have failed to reach a consensus on which types of AI are most effective. The research conducted by Dietz et al. (2009), Dietz et al. (2014), Hux et al., (2010), McKelvey et al. (2010), and Wallace et al. (2014) suggests that high context photographs are a form of AI that facilitate improved reading and auditory comprehension, as well as facilitate improved communication for persons with aphasia. These studies, in general, tended to include participants with more severe forms of aphasia, as indicated by participants' scores on the Western Aphasia Battery (WAB) (Kertesz, 1982), than the studies conducted by Brennan et al. (2005), Rose et al. (2011), and Wallace et al. (2012), which may shed light on the contradictory results. However, all the studies revealed a mixture of participants both in their particular aphasia type and the severity of the aphasia.

The study by Dietz et al. (2009) had a total of seven participants all with Broca's Aphasia; however, their severity ratings differed, while another study by Dietz et al. (2014) included 17 participants of whom 12 had non-fluent aphasia and the remaining five displayed fluent aphasia. Of the 17 participants, a total of four had a rating of severe aphasia, while one had moderate aphasia, and the others had mild aphasia. The study by McKelvey et al. (2010) included eight participants; four with severe Broca's Aphasia and four with severe Global aphasia. The study conducted by Wallace et al. (2014) had a total of 20 participants. Of those 20, ten had Broca's Aphasia, eight had Anomic Aphasia, one had Conduction Aphasia, and one had Wernicke's Aphasia. The majority of participants had a severity rating of mild aphasia (17 with mild and three with moderate).

The studies that revealed non-significant results also tended to have a diverse mixture of participants. The study by Wallace et al. (2012) included 21 participants with

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different aphasia types (16 participants had fluent aphasia, and five participants displayed non-fluent Broca's Aphasia) and severities (one with severe, eight with moderate and 12 with mild aphasia). Brennan et al. (2005) included nine participants with mild to moderate aphasia; this study did not specify the type of aphasia. Hux et al. (2010) included one participant with moderate Anomic Aphasia. Rose et al. (2011) included a total of 25 participants; however, only 22 were able to complete all the items in the written comprehension task and graphic preference survey. Of those 22 participants, 18 had Anomic Aphasia, two had Conduction Aphasia, and two had Broca's Aphasia. No individual severity ratings were available; however, the mean for the WAB AQ scores was 79.9, with a range of 33.8 (moderate) – 93.1 (mild), corresponding with an overall mild aphasia rating (Kertesz, 1982).

As can be seen from the discussion, the participants in the above-mentioned studies vary with regards to their aphasia type and severity, as well as the degree to which they benefit from different types of supports that aimed to facilitate improved comprehension. Continued investigation may assist in identifying the characteristics of people with aphasia who do and do not benefit from the various types of comprehension supports (Dietz et al., 2009) by conducting research that includes participants with similar types and severities of aphasia.

Nature of the tasks

As previously mentioned, the various studies under scrutiny yielded differing results. A contributing factor to this could be the diverse nature of the tasks employed in each case, which included (a) reading comprehension (Brennan et al., 2005; Dietz et al., 2009; Dietz et al., 2014; McKelvey et al., 2010; and Rose et al., 2011); auditory comprehension (Wallace et al., 2012; and Wallace et al., 2014); (b) recorded sentences (Wallace et al., 2014), sentences read aloud by the researcher; and (c) differing levels of task complexity.

Reading comprehension

Of the five studies that investigated reading comprehension, only three revealed significant differences between the conditions. McKelvey et al. (2010) aimed to determine the effect of personalization and contextualization of images on the preferences and accuracy of written word-picture matching for people with severe aphasia. Dietz et al. (2009) investigated the impact of (a) high context photographs,

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(b) low context photographs and (c) no photographs on the reading comprehension of narratives by people with aphasia. Similarly, in 2014, Dietz et al. investigated the effect of (a) no support, (b) visual support (photograph) and (c) linguistic support (keywords and headings) used as pre-task and during-task stimulation, on reading comprehension of people with aphasia. Although these studies revealed similar results, in that high context photographs provided improved reading comprehension for people with aphasia, the nature of the tasks was very different.

The procedures followed in each of these studies, as well as the length and level of complexity of the reading comprehension tasks differed. In the study by McKelvey et al. (2010), participants had to indicate their preference of visual stimuli that correspond to each of the single target words, as well as identify which of the three images accurately represented the target word. In the studies by Dietz et al. (2009) and Dietz et al. (2014), participants were required to read narratives of between 101–107 words, and a Flesch-Kincaid grade level of between 2.2 and 2.5 (Dietz et al., 2009), and 124–136 words and a Flesch-Kincaid grade level between 5.80 and 6.00 (Dietz et al., 2014). The Flesch-Kincaid grade level is one of the most widely used formula for determining readability, and rates text based on the United States of America's school grade level, ranging from one to 12 (Thomas, Hartley & Kincaid, 1975).

In the studies that revealed no significant differences between conditions, the nature of the tasks differed too. In the study by Rose et al. (2011), participants were required to complete a reading comprehension task which was comprised of 15 paragraphs, divided into three stimuli sets, namely five paragraphs containing no illustrations (set 1), five paragraphs containing black and white line drawings (set 2), and five paragraphs containing photographs (set 3). Each of the 15 paragraphs contained two sentences written in the same voice, and were equivalent for reading grade level, number of words per paragraph and number of words per sentence. (Rose et al., 2011). Participants choose the best single word from four possible options to complete the final sentence of each paragraph (Rose et al., 2011).

In the study by Brennan et al. (2005), participants' comprehension of written material was measured using 90 different paragraphs at three different reading grade levels. The participants had to choose the best word or phrase from an array of four to complete the final sentence of each paragraph. The 90 paragraphs were divided into six sets (set 1: no modifications, set 2: modified with simple vocabulary and syntax, set

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3: modified with large print, set 4: modified with use of increased amounts of white space between lines of print, set 5: modified with relevant pictures from clipart, set 6: modified with all of the above), and each set contained 15 paragraphs, comprising five paragraphs written at each of the three reading grade levels (i.e. five at reading grade 5, five at reading grade 6 and five at reading grade 7). The average Flesch-Kincaid grade level was calculated for each grade level, for each of the six sets, and ranged from 2.92 to 8.36 (please refer to Brennan et al., 2005 for all the data).

As can be seen from just the studies that investigated the reading comprehension of persons with aphasia, there is a large discrepancy between the types of tasks the persons with aphasia were required to do, as well as the nature and difficulty of the material they were required to read. This may be a reason for the conflicting results of these studies.

Auditory comprehension

The studies that investigated how AI can facilitate improved auditory comprehension for persons with aphasia differed with regards to the procedures and tasks done during the experimental conditions. Wallace et al. (2012) aimed to determine the changes in auditory comprehension accuracy experienced by persons with aphasia when given one of four types of AI during narrative reading; while Wallace et al. (2014) aimed to evaluate the accuracy and speed with which people with and without aphasia derive main action, background and inferential information from high context images.

In the study by Wallace et al. (2012), participants listened to four different narratives. Each of the narratives was presented to participants in one of the four conditions, which included no context photographs; low context drawings with embedded no context photographs; high context photographs and no visuo-graphic support conditions (Wallace et al., 2012). The narratives each contained five active voice sentences and two main characters. Each narrative conveyed a problem and a problem resolution. The narratives were equivalent for number of words, and Flesch-Kincaid grade level (range: 5.2–5.5). The visuo-graphic stimuli in all conditions were non-personalized in nature. In the no context photograph and low context drawing with embedded no context photograph conditions there were five images, while in the high context photograph condition there were two scenes that were depicted. During the reading of the narrative, the researcher pointed to each of the target items within the

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visuo-graphic stimuli. After listening to each narrative, the researcher removed the visuo-graphic stimuli and presented participants with comprehension items to assess their understanding of the information presented.

In the study by Wallace et al. (2014), participants were required to identify the high context image from an array of four, represented on a computerized touch screen monitor, that best matched a digitally recorded sentence stimulus. Each of the 60 images was separated into three sets, and paired with one of the stimulus sentences from the three sets, which included (a) main action information, (b) background information, and (c) inferential information. Each stimulus sentence had between four and nine words. The results of the study showed that participants with aphasia were slower and less accurate than their age-equivalent controls without aphasia in identifying the correct image that represented either the main action, background or inferential information presented in each stimulus sentence; however, the persons with aphasia were able to derive substantial information from the high context images.

The above-mentioned studies differed with regards to the nature of the tasks required of participants in terms of the procedures carried out, the complexity and the length of the task and comprehension items. These disparities may have contributed towards the difference in results between the studies.

Pre-task stimulation

Another area that has become prominent in recent literature is the use of pre-task stimulation (Dietz et al., 2014; Wallace et al., 2012, Wallace et al., 2014). Pre-task stimulation refers to viewing visual or linguistic stimuli, or listening to predictive sentences prior to exposure to the auditory or reading comprehension task (Dietz et al., 2014). Literature supports the notion that pre-task stimulation assists the performance of comprehension tasks for people with aphasia by activating prior knowledge and contextualizing information, thereby allowing the individual with aphasia to allocate resources more successfully to the task (Dietz et al., 2014). Only the studies by Dietz et al. (2014) and Wallace et al. (2014) made use of pre-task stimulation. This may be considered a contributing factor towards the significant improvement in reading and auditory comprehension found in these studies, respectively.

2.7 Summary

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Previous research has predominantly focused on the various types of AI that can be employed for persons with aphasia. No research to date has been conducted on the frequency of AI recommended for persons with aphasia. Therefore, the purpose of this study is to determine the effect of AI, using high context images and Picture Communication Symbols™ (PCS) (no context images) presented at a frequency of 70%, on the accuracy of auditory comprehension for individuals with chronic aphasia.

3. Methodology

3.1 Research aims

3.1.1 Main aim

The main aim of the study is to determine the effect of augmented input (AI), presented at a frequency of 70%, on the accuracy of responses to auditory comprehension items, based on narratives, for persons with chronic aphasia.

3.1.2 Sub-aims

The sub-aims of the study are:

I. To determine the accuracy of responses on auditory comprehension items based on a narrative during the AI condition
II. To determine the accuracy of responses on auditory comprehension items based on a narrative during the no AI condition
III. To compare the accuracy of responses on auditory comprehension items between the AI and no AI conditions

3.2 Research design

A within-subject design was used to determine the effect of the AI on the auditory comprehension of the narratives (Schlosser et al., 2013). This design allows for each participant to be exposed to every condition in the experiment (Barlow & Hayes, 1979; Charness, Gneezy & Kuhn, 2012).

This design is advantageous as there is a reduction in error variance associated with differences amongst participants (Barlow & Hayes, 1979; Charness et al., 2012). The disadvantage of this design is the fact that performance in one condition may affect performance in the second condition, known as the carryover effect (Barlow & Hayes, 1979). The order in which conditions are presented to participants may also affect their performance. Counter-balancing by means of alternation of the narratives and

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conditions was done to control for order and carryover effects (Barlow & Hayes, 1979). Table 2 illustrates the alternation of narratives and conditions across participants.

3.3 Research phases

The research comprised of two phases as outlined in Table 3. Namely, Phase I: Pilot Phase, and Phase II: Main Study. The purpose of the Pilot Phase was to: (a) adapt and develop materials and measuring instruments to be used in the study, (b) assess the feasibility of the research, and (c) recruit participants. The Main Study involved collecting and analysing data from participants.

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Table 2

Assignment of narratives to conditions and order of condition presentation

Participant number	Condition (AI or no AI)	Narrative
1, 5, 9	AI	1
	No AI	2
2, 6, 10	No AI	1
	AI	2
3, 7, 11	AI	2
	No AI	1
4, 8, 12	No AI	2
	AI	1

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Table 3

Research phases

RESEARCH PHASES		
Phase I: Pilot Phase		
1.1 Adaptions 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 materials from the study conducted by Wallace et al. (2012).	The pilot study aimed to assess the feasibility of the study in terms of recruitment strategy, participant selection criteria, screening procedures, 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 Screening procedures	*2.2 Data collection*	*2.3 Data analysis*
Screening procedures and biographical questionnaires were completed at participants' houses. Significant others were present to assist with the consent process and the completion of biographical questionnaires.	Data collection was completed at the participants' houses. Comprehension items were used to capture the data.	Data was analysed using descriptive statistics.

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3.4 Equipment and materials

3.4.1 Equipment

An Apple MacBook Air video recorder was used to capture all experimental sessions.

3.4.2 Materials

3.4.2.1 Permission letter to private practice owner

An information letter and permission slip (Appendix A) was given to the Speech Therapy private practice owners to obtain permission to recruit participants for the study from their practice. The 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.

3.4.2.2 Permission letter to hospital manager

An information letter and permission slip (Appendix B) was given to the hospital manager to obtain permission to recruit participants from the intermediate care facility. The letter contained information pertaining to what the study entails, the purpose of the study, the selection criteria of participants and the requirements from the hospital.

3.4.2.3 Permission letter to NGO

An information letter and permission slip (Appendix C) was given to the NGO to obtain permission to recruit participants from their stroke support groups. The 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.

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3.4.2.4 Information letter for persons with aphasia

Letters were given to the participants that provided information pertaining to what the study entails, the purpose of the study, the expected duration of the study, and the risks and benefits of the study. All information was written in short and simple sentences and contained graphic images to enhance the meaning (Appendix D).

3.4.2.5 Information letter for significant other

Letters were given to the participants' significant others that provided information pertaining to what the study entails, the purpose of the study, the expected duration of the study, and the risks and benefits of the study (Appendix E).

3.4.2.6 Letters of consent from persons with aphasia

The persons with aphasia signed consent forms. The forms were written in simple English and included visual aids to enhance understanding (Appendix F).

3.4.2.7 Letters of consent from significant others

Participants in the study have impaired comprehension; therefore, consent was obtained from a significant other (Appendix G) as well as from the participants. Individuals with communication and comprehension difficulties are considered "vulnerable", and therefore informed consent from a significant other was needed. Consent was also needed from the significant other as they participated in the study by assisting to complete the biographical questionnaire.

3.4.2.8 Biographical questionnaire

Biographical questionnaires (Appendix H) were given to the participants and/or significant others to complete to obtain information about the person with aphasia. This included such information as gender, age, time since onset of CVA, home language, education level, previous occupation, marital status, side of hemiplegia/paresis, handedness prior to CVA, use of mobility aids, problems with vision, hearing, or memory, information pertaining to any prior language or cognitive difficulties, receiving of speech therapy services, frequency of speech therapy services, focus of speech therapy services, and exposure to AAC/pictures in therapy.

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3.4.2.9 Western Aphasia Battery (WAB)

The aphasia quotient (AQ) section of the Western Aphasia Battery (WAB) (Kertesz, 1982) was used to determine the type and severity of the language difficulties experienced by the participants (Appendix I). The WAB assesses the linguistic skills most frequently affected by aphasia. The comprehension subtests were used to ascertain the severity of comprehension difficulties. The receptive language 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. Only participants with a receptive language score of above 4 out of 10 were included in the study.

3.4.2.10 Visual Perceptual Skills screening test

Visual perceptual skills were assessed by using a cancellation task developed by the researcher. A similar task was used in the study by Wallace et al. (2012), in which participants had to scan 25 names and cross out their name each time it occurred. In this study, participants were required to scan ten words and cross out a non-personalized word each time it appeared (Appendix J).

3.4.2.11 Written Choice Strategy screening test

Participants were required to answer four cloze-type statements using Written Choice Strategy (Garrett & Beukelman, 1995) with one-word options that included three foils and one correct answer (Appendix K). Participants pointed to the answer they deemed to be correct, and the researcher would then circle the answer indicated by the participant.

3.4.2.12 High context photograph

Two high context photographs associated with each narrative were used as pre- and during-task stimulation (Appendix L-M). The photographs used were from the study by Wallace et al. (2012). The photographs are non-personalized in nature. They were in colour and appeared on a laminated sheet of paper. Each photograph measured 13.5 x10.5 cm.

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3.4.2.13 Narratives

Two narratives, used by Wallace et al. (2012), were read to participants (Appendix N-O). Minor changes to vocabulary were made in order for the narratives to be appropriate for the South African population. The narratives were balanced for equivalence. Each narrative contained five active voice sentences and two main characters (Wallace et al., 2012). Each story covered a problem and a solution. The narratives were balanced for number of words (range: 74–75) and Flesch-Kincaid grade level (range: 5.2–5.5) (Wallace et al., 2012).

3.4.2.14 Augmented input using no context PCS images

The narratives were supplemented with no context Picture Communication Symbols™ (PCS) images. PCS is the most widely used, aided graphic symbol set in the world (Beukelman & Mirenda, 2013), and was developed by Roxanna Johnson in the 1980s (Johnson, 1981). It is readily available and widely used in South Africa (Bornman, Bryen, Kershaw, & Ledwaba, 2011).

Each narrative had a total of 75 words. The researcher and three postgraduate Speech Therapists independently read each narrative, and devised a list of content words, which consisted of nouns, verbs and “others” (adjectives, prepositions, and question words). Percentage agreement (McMillan & Schumacher, 2010) was calculated to determine the level of agreement between the researcher and postgraduate Speech Therapists in terms of content words identified. Percentage agreement was calculated using the following formula:

$$\frac{Total\ number\ of\ agreements}{Total\ number\ of\ agreements + disagreements}\ \mathrm{X}\ 100 = Percentage\ agreement$$

$$\frac{205}{205 + 30}\ \mathrm{X}\ 100 = 87.23\%$$

Percentage agreement was 87.23%, which is considered excellent (McMillan & Schumacher, 2010).

Of the 75 words in each narrative, 33 words from Narrative 1 and 38 words from Narrative 2 were identified as content words. Owing to the fact that the number of nouns (Narrative 1 = 12; Narrative 2 = 19), verbs (Narrative 1 = 14; Narrative 2 = 13) and “others” (Narrative 1 = 7; Narrative 2 = 6) differed between each story, 70% of the content words were represented using the no context PCS images (Appendix P–Q).

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This is the recommended frequency of AI used for children with LNFS (Goosens, Jennings & Kinahan, 2000). There is no literature on the recommended frequency of AI for the adult population. This corresponded to a total of 24 no context PCS images for each narrative, which were selected from the Boardmaker Online™ library by the researcher. The images appeared in colour on a laminated sheet, with 12 images per page, and each image measuring 6 x 4.5cm.

An expert panel review of the PCS images used for each narrative was conducted. The experts were three individuals who have postgraduate degrees, and work in the field of AAC. The experts were required to complete a questionnaire in which they judged the representativeness of the PCS image to the corresponding word/phrase from the narrative (Appendix R). The results of the expert panel were analysed by calculating a total score for each PCS image out of a possible score of nine points. All PCS images that obtained a total score of five or less, which indicated that they may not be representative of the concepts they depicted, were either adapted or replaced. None of the PCS images scored five or below, so no changes were made.

A panel review of the no context images was conducted with the participants of the pilot study and their significant others. The aim of the panel was to determine the appropriateness of the no context images in relation to the narrative using a questionnaire (Appendix S).

3.4.2.15 *Expert panel review questionnaire*

A questionnaire that consisted of the 24 PCS images that corresponded to each of the narratives and a three point Likert scale, was developed to be answered by an expert panel (Appendix R). The three Likert points were: 1 = the symbol doesn't represent the meaning of the word/s at all; 2 = the symbol represents the meaning of the word/s a little; 3 = the symbol represents the meaning of the word/s a lot. Space was provided on the questionnaire for the experts to make comments or suggestions for change.

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3.4.2.16 *Pilot study questionnaire for person with aphasia and significant other (peer panel review)*

A set of nine questions was developed to be answered by participants from the pilot study, or their significant others. The questions related to the understandability of the information and consent letters for the persons with aphasia, the clarity of instructions given during the screening procedures and experimental task, the appropriateness of the pictures used, the appropriateness of the vocabulary used in the narratives and comprehension items, and comments on the duration of the screening procedures and experimental tasks (Appendix S).

3.4.2.17 Comprehension items

The comprehension items made use of Written Choice Strategy (Garrett & Beukelman, 1995), in which 15 cloze-type statements with four response options associated with each narrative were used to assess participants' comprehension of the narrative (Appendix T–U). These items were developed and used by Wallace et al. (2012). A passage dependency index was calculated for each narrative and associated comprehension items (Wallace et al., 2012). This was done to ensure that the comprehension items truly measured comprehension related to the particular narrative. Minor changes with regards to the vocabulary were made to make the comprehension items more appropriate for the South African population.

3.4.2.18 Procedural checklist and script for screening procedures

The checklist covered: (a) greeting the participants and significant others; (b) introducing the researcher; (c) thanking them for agreeing to participate; (d) explaining the purpose of the study; (e) explaining the nature of the study; (f) explaining the duration of the study; (g) explaining the information letter; (h) signing the consent form; (i) explaining and completing the biographical questionnaire; (j) explaining and administering the WAB; (j) explaining and administering the Visual Perceptual Skills screening test; (k) explaining and administering the Written Choice Strategy screening test; (l) thanking participants; (m) offering participants a comfort break; (n) informing participants that the experimental tasks and video recording will start in 15 minutes (Appendix V).

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3.4.2.19 Treatment integrity checklist and script for experimental task

The checklist and script was developed to ensure that the two conditions were carried out as specified in order to maintain treatment integrity across participants (Schlosser, 2002). The script of procedures included: (a) inform the participant about what will occur during the experimental tasks; (b) provide the participant with instructions on what to do during the experimental task; (c) the researcher shows the high-context photograph and no context PCS images to the participant for one minute before reading the narrative; (d) the researcher reads the narrative twice; (e) in the AI condition, the researcher reads the narrative while simultaneously pointing to the no context PCS symbols; in no AI condition, the researcher reads the narrative without pointing to the no context PCS symbols; (f) the high-context image and no context PCS images remain in front of the participant during the reading of the narratives; (g) the high-context image and no context PCS images remain in front of the participant during the reading of the comprehension items; (h) the researcher reads the comprehension item and the four options twice, and (i) the researcher follows the outlined Written Choice Strategy procedures for presentation of the comprehension items (Appendix W).

3.4.2.20 *Questionnaire for research assistant on pilot study*

A set of four questions was developed to be answered by the research assistant based on the pilot study. The questions related to: (a) what were some of the challenges that occurred during the experimental task; (b) what was done well during experimental task; (c) were the same procedures followed amongst the different participants; and (d) comments on how to improve the treatment integrity amongst the different participants (Appendix X).

3.4.2.21 Feedback brochure

A brochure outlining the aims of the study, participants, methodology, findings and implications was made in the form of a Microsoft PowerPoint document (Appendix Y). This was provided to the participants and their significant others, as well as the Speech Therapy private practice owners, NGO and hospital manager who gave consent to be in the study, in order to disseminate the findings.

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3.5. Pilot study

3.5.1 Objectives

Pilot studies are designed to assess the feasibility of the research, and are useful in helping to enhance the likelihood of success of the main study (Thabane et al., 2010). The aim of this pilot study was to assess the feasibility and duration of the recruitment strategy, participant selection criteria, screening procedures, data collection procedure, materials and equipment, data capturing and analysis methods that will be used for the main study.

3.5.2 Participants

The hospital manager at one intermediate care facility was contacted. Consent was given (Appendix Z) and participants were recruited from this site. Three participants with aphasia secondary to a left CVA, and their significant others, were included in the pilot study. Participant descriptions are presented in Table 4. The participants met similar selection criteria for the main study; however, they differed with regards to the amount of time that had elapsed post stroke, and the severity of their aphasia. This difference was not considered a threat as the reason for this pilot study was to assess the processes, resources (including materials and time) and the management of data; not to collect data for the main study (Thabane et al., 2010).

3.5.3 Aims, materials, procedures, results and recommendations

The aims, materials, procedures, results and recommendations of the pilot study are summarized in Table 5.

3.5.4 Summary of pilot study

The pilot study highlighted the areas that would need modification for the main study. This included clearer information to be given in all the information letters, and more concise instructions given to the participant and their significant other prior to conducting the experimental task. Significant others wanted participants to succeed during the comprehension tasks, so would repeat items, or translate into the participant's home language. In the main study, significant others were asked to leave after the consent letters were signed and biographical questionnaires were completed. A script was also recommended by the research assistant to ensure treatment integrity across participants.

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Table 4

Pilot study participant descriptions

Participant number	Age (in years)	Gender	Handedness (prior to CVA)	Education level	First Language	Time post stroke (in months)	Auditory comprehension score	WAB classification	WAB Aphasia Quotient
1	48	Male	Right	Below grade 9	Afrikaans	77	3.4	Severe Global Aphasia	20.2
2	78	Male	Right	Below grade 9	Afrikaans	2	2.5	Severe Global Aphasia	5
3	70	Female	Right	Below grade 9	Afrikaans	2	4.8	Moderate Broca's Aphasia	50.8

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Table 5
Aims, materials, procedures, results and recommendations of pilot study

Aims	Materials	Procedures	Results	Recommendations
1. To evaluate the feasibility of the recruitment strategy	Letters of information and permission slips	Letters of information and permission slips were emailed to (a) private practice owners, (b) hospital managers, (c) NGOs	People did not always respond to emails	Personal contact via phone calls to be made, and stroke support groups to be visited.
2. To evaluate the feasibility of the participant selection criteria in terms of: a. Has aphasia secondary to a left CVA b. Has chronic aphasia c. Has no history of language or cognitive disability prior to CVA d. Has normal or corrected vision e. Has normal or corrected hearing f. Is proficient in English	Biographical questionnaire	Determined via the biographical questionnaire	a. All participants had aphasia secondary to a left CVA b. Only 1 participant had chronic aphasia c. All participants had no history of cognitive or language disability prior to CVA d. One participant did need spectacles but did not have e. All participants had normal or corrected vision f. All participants or their significant others reported to be proficient in English; however 2 significant others translated into the participants' home	The recruitment letters (to private practice owners, NGOs and hospital managers), information letters to significant others, and the instructions given during the sessions with the participants and their significant others need to be made clearer.

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Aims	Materials	Procedures	Results	Recommendations
			language during the session when the participant was incorrectly answering questions	
3. To evaluate the feasibility of the participant selection criteria in terms of auditory comprehension difficulty	Western Aphasia Battery (WAB) (Kertesz, 1982).	Administration of WAB; scores of 4 or above on auditory comprehension subtest	Two of the three participants had auditory comprehension scores lower than 4. These participants did not understand what was required of them during the experimental task.	Participants must have an auditory comprehension score of 4 or higher. Participants with scores lower than 4 will be excluded from the main study. Information letters will include this requirement.
4. To evaluate the feasibility of the participant selection criteria in terms the ability to answer questions using written choice strategy	Written choice strategy screener	Participant to answer 4 questions with 100% accuracy using written choice strategy.	Only one of the participants was able to respond with 100% to the written choice strategy screener. This may have been due to the fact that the other participants' language impairments were too severe to understand the statements.	Participants will be required to accurately complete 4 written choice strategy statements. Participants who are not able to complete these accurately will be excluded from the main study. Information letters will include this requirement.
5. To determine whether the information letter for the person with aphasia was understandable	a) Information letter for person with aphasia b) Questionnaire for person with aphasia/significant other	Participants and their significant others were asked if the information is understandable.	Participants and their significant others reported that the images helped them to understand the information letter.	No changes recommended.
6. To determine whether the consent letter was understandable for the person with aphasia	a) Consent letter for person with aphasia b) Questionnaire for person with aphasia/significant other	Participants and their significant others were asked if the information was understandable.	Participants and their significant others reported that the images helped them to understand the consent letter.	No changes recommended.

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Aims	Materials	Procedures	Results	Recommendations
7. To evaluate the ease of administration of the screening procedures by participants and significant others	a) WAB b) Visual perceptual screening tool c) Written choice strategy screening tool d) Questionnaire for person with aphasia/significant other	Participants and significant others were asked about how they found the screener procedures in terms of ease, and clarity	All participants and their significant others found the instructions during the screening procedure to be clear and understandable	No changes recommended.
7. To determine the duration of time for the administration of screening procedures	a) WAB b) Visual perceptual screening tool c) Written choice strategy screening tool d) Questionnaire for person with aphasia/significant other	Participants and significant others were asked about how they found the duration of time needed to complete the screening procedures. The researcher timed the duration of the screening procedures.	All participants and their significant others reported that the duration of the experimental task was acceptable. No participants reported fatigue. The screening procedures took approximately 1 hour.	No changes recommended.
8. To evaluate the appropriateness of the high context photographs used as pre-task stimulation	a) 2 x high context photographs b) Questionnaire for person with aphasia/significant other	The participants and their significant others were asked about how appropriate they find the photographs.	All participants and their significant others found the high-context images to be appropriate.	No changes recommended.
9. To evaluate the appropriateness of the no context PCS symbols used in the augmented input conditions	a) 2 x sets of 25 PCS symbols b) Questionnaire for person with aphasia/significant other	The participants and their significant others were asked about how appropriate they find the PCS symbols.	All participants and their significant others found the AI images to be appropriate.	No changes recommended.
10. To evaluate the appropriateness of the content and vocabulary of the narratives	a) 2 x narratives b) Questionnaire for person with aphasia/significant other	Participants and their significant others were asked to comment on how appropriate they found the narrative in terms of vocabulary and content.	One significant other reported that the vocabulary used was not always applicable to the South African population.	Some of the vocabulary in the narratives was changed to be more appropriate for the South African context. The word “wallet” was changed to “purse”, and the

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Aims	Materials	Procedures	Results	Recommendations
				word “purse” was changed to “handbag”.
11. To evaluate the appropriateness of the content and vocabulary of the comprehension items	a) 2 x sets of 15 cloze-type statements b) Questionnaire for person with aphasia/significant other	Participants and their significant others were asked to comment on how appropriate they found the comprehension items in terms of vocabulary and content.	Owing to the fact that the vocabulary used in the comprehension items is based on the narratives, one significant other reported that the vocabulary used was not always applicable to the South African population.	Some of the vocabulary in the comprehension items was changed to be more appropriate for the South African context. The word “wallet” was changed to “purse”, and the word “purse” was changed to “handbag”.
12. To determine the duration of time taken to complete the comprehension items	a) 2 x sets of 15 cloze-type statements b) Questionnaire for person with aphasia/significant other	Participants and significant others were asked about how they found the duration of time needed to complete the comprehension items. The researcher timed how long it took to complete the comprehension items.	All participants and their significant others reported that the duration of the experimental task was acceptable. No participants reported fatigue. The experimental task took approximately 30 minutes.	No changes recommended.
12. To evaluate the effectiveness of the checklist used to maintain treatment integrity during the experimental task	a) Treatment integrity checklist b) Research assistant questionnaire	The research assistant was required to answer yes or no to a set of 5 questions related to the experimental condition. The treatment integrity for the 3 participants was calculated. The research assistant was also required to comment on the effectiveness of the procedural checklist, used during the viewing of the video recorded experimental	The research assistant reported that the checklist (in the form of yes/no questions) was somewhat effective in maintaining treatment integrity. She reported that some of the checklist items were unclear.	The yes/no system with 5 questions was changed to script and protocol consisting of 26 steps that related to experimental sessions. The research assistant will be required to indicate if the step is complete using a tick box system.

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Aims	Materials	Procedures	Results	Recommendations
		conditions, to maintain the treatment integrity.		
13. To ensure the optimal working of the recording device	MacBook Air video camera	Video record the participant and researcher during the experimental condition.	The MacBook Air video camera captured both sound and visuals accurately.	No changes recommended.

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3.6 Main study

3.6.1 Sampling and recruitment

Purposive sampling was used to recruit and select participants. Participants were selected based on certain pre-determined selection criteria (McMillan & Schumacher, 2010). Participants were recruited by two different methods, which included: (a) contacting private Speech Therapists who specialize in the treatment of aphasia, and (b) contacting a Non-Governmental Organization (NGO) that offers stroke support groups.

The owners of the private practice and the chairperson of the NGO were contacted telephonically and via email, and 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 this initial email.

The researcher telephonically contacted 16 owners of private Speech Therapy practices in the Cape Town area that specialize in aphasia therapy, and informed them of the nature and purpose of the study. If the owner gave permission to assist with the recruiting of participants, the participant selection criteria and information letter was emailed to them. The private practice owners were asked to check their records of past and present clients for any potential participants that met the inclusion criteria. A total of five private practice owners gave consent, and had clients that met the inclusion criteria. Individuals that met the selection criteria were then contacted and asked to participate in the study. A total of 14 potential participants were recruited from this site.

One NGO was contacted, and consent was obtained. An advertisement was placed in the NGO's monthly newsletter, and 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. A total of two potential participants were identified from this site.

A list of all the interested potential participants (16 persons with aphasia) from the different sites were drawn up. The researcher called all the candidates or their significant others to verbally inform, and invite them to participate in the research. Those candidates that were willing to participate supplied the researcher with an email address, after which the formal information letter was sent to the participant and their significant other. The 16 potential participants that agreed to participate in the study

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were contacted, and a date and time was arranged to meet. Of these only 12 participants met the selection criteria. Four participants were excluded, as they did not meet the criteria of having a mild-moderate auditory comprehension difficulty and were not able to answer the written choice strategy screening test questions with 100% accuracy.

3.6.2 Selection criteria

Participant selection criteria are presented in Table 6.

3.6.3 Participants

Participants comprised of 12 persons with chronic aphasia, of ages that ranged from 36 to 89 years old (*M*=63.92). Participants were eight males and four females. All participants had aphasia secondary to a left CVA and were at least six months post stroke. The number of months post stroke ranged from six to 155 months (*M*=38.58). Eight participants were English first language speakers, three were Afrikaans first language speakers and one was a German first language speaker. All participants had some type of formal education. Three participants had a level of education of grade 9 or below, one participant had grade 11, three participants had matric, one participant had a diploma, three participants had undergraduate degrees and one participant had a postgraduate degree. Eight participants were married, one participant was single, one participant was divorced and two participants were widowed. 11 participants were right hand dominant prior to the stroke; one participant was left hand dominant. Six participants made use of mobility aids such as walking sticks and wheelchairs. 11 participants had problems with their vision and wore spectacles. No participants had any difficulty with their hearing, or had a history of language or cognitive impairments prior to the stroke. A total of seven participants reported difficulties in memory following their stroke. All twelve participants received Speech Therapy services following their stroke; seven of those participants were exposed to AAC or picture communication in Speech Therapy. The scores for auditory verbal comprehension subtest on the WAB (Kertesz, 1982) ranged from 5.45–8.65 (*M*=7.075), and the aphasia quotient ranged from 25–84.1 (*M*=52.52). Participant descriptions are presented in Table 7.

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Table 6

Participation selection criteria

Criteria	Theoretical Justification	Method
Aphasia secondary to left CVA	Aphasia can be caused by any type of brain injury; however, it is predominately acquired as a result of a CVA to the left cerebral hemisphere (Garret & Lasker, 2005). Characteristics of individuals with etiologies of aphasia other than CVA may differ slightly from those with aphasia from CVA.	As determined by information provided in the biographical questionnaire
Mild-moderate auditory comprehension difficulty as determined by a score of 4 or above on the auditory verbal comprehension subtest of the WAB (Kertesz, 1982).	Auditory comprehension cannot be so severely affected that it prevents participants from understanding the instructions of the study (Dietz et al., 2014; Rose et al., 2011).	Performance scores above 4 out of a possible 10 on the auditory verbal comprehension section of aphasia quotient section of the Western Aphasia Battery (WAB) (Kertesz, 1982).
Chronic aphasia (minimum of 6 months post incident)	Participants needed to be outside of the period of spontaneous recovery to increase the stability of their performance (Cherney & Robey, 2005).	As determined by information provided in the biographical questionnaire
Proficient in English	Participants are required to have been proficient English speakers prior to the onset of aphasia in order to ensure maximum comprehension of narratives and questions, which will be conducted in English.	As determined by information provided in the biographical questionnaire
No history of language or cognitive disability prior to CVA	Aphasia is a language impairment that is acquired after brain injury; pre-morbid language impairments may bias the results (Garrett & Lasker, 2005).	As determined by information provided in the biographical questionnaire
Has a significant other (family member or friend)	Owing to the fact that individuals with aphasia may have impaired comprehension (Wallace et al., 2012), co-lateral information may need to gathered from the participants' significant others.	As determined by information provided in the biographical questionnaire

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Criteria	Theoretical Justification	Method
Normal or corrected hearing	Participants need to be able to hear what the researcher is saying as this study measures auditory comprehension.	As determined by information provided in the biographical questionnaire
Normal or corrected vision	Participants need to be able to accurately see the visual images used as augmented input.	As determined by performance of Visual Perceptual Skills screening test
Ability to answer, with 100% accuracy, questions using written choice strategy	This is the method that will be used to answer the questions in the experimental task.	As determined by performance on Written Choice Strategy (Garrett & Beukelman, 1995) screening test

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Participant number	Age (in years)	Gender	Handedness (prior to CVA)	Education level	First Language	Time post stroke (in months)	Auditory comprehension score	WAB classification	WAB Aphasia Quotient
1	89	Female	Right	Below grade 9	English	6	6.3	Mild Broca's Aphasia	52.2
2	59	Male	Right	Below matric	Afrikaans	10	8.25	Mild Broca's Aphasia	69.5
3	59	Male	Right	Degree	English	45	6.45	Mild Broca's Aphasia	60.7
4	36	Male	Left	Matric	English	11	8.1	Severe Broca's Aphasia	25
5	54	Male	Right	Degree	English	43	6.25	Mild Broca's Aphasia	62.1
6	76	Male	Right	Below grade 9	English	93	7.2	Moderate Conduction Aphasia	49.4
7	73	Female	Right	Below grade 9	English	27	5.5	Moderate Broca's Aphasia	38.6
8	47	Male	Right	Degree	English	23	7.65	Mild Broca's Aphasia	60.1
9	53	Female	Right	Matric	English	7	8.95	Moderate Broca's Aphasia	47.5
10	67	Male	Right	Postgraduate degree	German	27	6.15	Moderate Broca's Aphasia	36.3
11	68	Male	Right	Diploma	Afrikaans	155	5.45	Moderate Broca's Aphasia	44.7

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12	86	Female	Right	Matric	English	16	8.65	Mild Anomic Aphasia	84.1

Table 7

Participant descriptions

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3.7 Procedures

3.7.1 Ethics

Ethics approval was obtained from the University of Pretoria, Faculty of Humanities Research Ethics Committee (Appendix AA).

The Helsinki Declaration (WHO, 2001) summarizes the ethical principles relevant to research conducted with human participants. These include respect for persons, beneficence and justice which were adhered to in this study

Respect for persons encompasses the expectation of confidentiality and privacy of personal information collected as part of a research project (Moran, 2006). All data will remain confidential to the researcher, and no participant will be identifiable in the final report or any subsequent publications or presentations (Endacott, 2004).

The principle of informed consent is vital in this study in order to ensure that all participants are aware and fully understand their role in the study. Informed consent was obtained by explaining the purpose, expected duration and procedure of the study to both participants and their significant others. Additional actions were taken to ensure that persons with aphasia had the opportunity to give informed consent without being coerced (Penn, Frankel, Watermeyer & Muller, 2009). This included writing the information in simple English, and including visual aids to enhance understanding. The significant other was present to observe the person with aphasia give their consent, and was requested to ensure that the person with aphasia understood the study and gave consent without being coerced (Penn et al., 2009). Owing to the fact that persons with aphasia may have reduced comprehension, consent was obtained from a significant other, as well as from the participants themselves. 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.

Beneficence refers to the concept of doing good or protecting from harm (Cassell, 2000). The researcher avoided any possible negative consequences by ensuring that participation in the study was not during a time that therapy was scheduled, and occurred in an environment that was familiar to the participants and their significant others. Benefits of this study include allowing researchers and clinicians to better understand how to facilitate improved comprehension for persons

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with aphasia, and therefore provide treatment that is evidence-based.

Justice refers to the equitable selection of participants, as well as inclusiveness in research and fair distribution of benefits and burdens (Cassell, 2000). The participants that took part in the study may directly benefit, as they are part of the population of individuals that will potentially benefit from the results of the study.

3.7.2 General procedures

Following ethics approval, written permission was granted for participants to be recruited from private speech therapy practices (Appendix BB), and from a NGO (Appendix CC). Individuals that met the selection criteria were contacted and asked to participate in the study. If willing to participate, participants and their significant others were given an information letter via email (Appendix D & E respectively), and a date and time was arranged for a meeting.

3.7.3. Data collection

Those persons with aphasia and their significant others who had verbally given their consent to participate in the research study were met individually by the researcher in their homes. The researcher introduced herself. The researcher explained the procedures in the study for (a) obtaining informed consent; (b) completing biographical information; (c) completing the screening procedures; and (d) completing the experimental tasks.

3.7.3.1 Consent

During this meeting, consent forms were distributed to the persons with aphasia (Appendix F) and their significant others (Appendix G). Owing to the fact that persons with aphasia may have reduced comprehension, consent was obtained from them and their significant other. All persons with aphasia and their significant others provided written informed consent to take part in the study. The consent forms were collected.

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3.7.3.2 Screening procedures

Once the consent letters had been signed by both the persons with aphasia and their significant others, the screening procedures began. Scripts were used to enhance procedural reliability of screening procedures (Appendix V). The script covered (a) the biographical questionnaire, (b) the screening procedures which included (i) administration of the WAB, (ii) Visual Perceptual Skills screening test and (iii) Written Choice Strategy screening test. The scripts allowed the researcher to follow the same procedure for all participants.

At the meeting, biographical questionnaires (Appendix H) were distributed to the persons with aphasia to complete. The researcher or significant other could assist the person with aphasia complete the biographical questionnaire. The biographical questionnaires were collected.

The Visual Perceptual Skills screening test (Appendix J), followed by the Written Choice Strategy screening test (Appendix K), and aphasia quotient section of the WAB (Kertesz, 1982) (Appendix I) were completed. A total of 16 persons with aphasia were screened. Four persons with aphasia were unable to complete the screening procedures and did not meet the inclusion criteria, so were excluded from the study. These persons with aphasia and their significant others were thanked for their time.

12 persons with aphasia met the inclusion criteria and passed the screening procedures, and were allowed to continue with the experimental task. A 15-minute comfort break was offered to the persons with aphasia, before continuing with the experimental condition.

3.7.3.3 Experimental task

Following a comfort break, the experimental tasks began. The experimental tasks were video recorded using a MacBook Air laptop, positioned on a table or desk in the participant's home. The assignment of narratives to experimental conditions and the order of conditions presented was varied across participants to reduce the possibility of order effects (Wallace et al., 2012), and participants were randomly assigned to different conditions as described in Table 2.

Participants 1, 5 and 9 were read Narrative 1 (Appendix N) first with AI, and Narrative 2 (Appendix O) second with no AI. Participants 2, 6 and 10 were read Narrative 1 (Appendix N) first with no AI, and Narrative 2 (Appendix O) second with AI.

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Participants 3, 7 and 11 were read Narrative 2 (Appendix O) first with AI, and Narrative 1 (Appendix N) second with no AI. Participants 4, 8 and 12 were read Narrative 2 (Appendix O) first with no AI, and Narrative 1 (Appendix N) second with AI.

The participants were shown a high context photograph (Appendix L & M) and the no context PCS images (Appendix P & Q) as pre-task stimulation. During this time the researcher informed the participant that the images gave some information about the narrative that was about to be read. The pre-task stimulation lasted one minute, and then the narrative was read to the participant twice. 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 both the AI and no AI condition.

During the AI condition, the researcher simultaneously read the narrative and pointed to the corresponding no context PCS images, which represented 70% of the content words in each narrative.

During the no AI condition, the researcher did not point to the no context PCS images while reading the narrative; however, the images were still available for the participant.

After the researcher had completed the narrative reading, the comprehension items (Appendix T & U) were introduced. The researcher read aloud each comprehension item twice, and simultaneously pointed to each of the response options. The participant indicated their response by pointing to the desired option, or verbally saying the option aloud. The researcher repeated the participant's choice, and then circled it before moving on to the next comprehension item. After completing all 15 of the comprehension items related to Narrative 1, the comprehension items, high context and no context PCS images were removed from the table before commencing with Narrative 2.

During the reading of the second narrative, identical procedures to those outlined above were followed, except the condition (AI or no AI) and the narrative (1 or 2) were altered.

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3.8. Reliability

3.8.1 Procedural integrity

The researcher read from a script and used a checklist (Appendix W) when conducting the experimental condition to reduce discrepancy across participants (Schlosser, 2002). The experimental tasks were video recorded. A post-graduate physiotherapist viewed 40% (Schlosser, 2002) of the video recordings and evaluated the treatment integrity in the two conditions using the treatment integrity checklist and script. Procedural integrity (McMillan & Schumacher, 2010) was expressed as a percentage and was calculated using the following formula:

$$\frac{Number\ of\ correct\ steps}{Total\ number\ of\ steps}\ \mathrm{X}\ 100 = Procedural\ Integrity$$

$$\frac{128}{130}\ \mathrm{X}\ 100 = 98.5\%$$

Procedural integrity was high at 98.5%, indicating good procedural consistency (McMillan & Schumacher, 2010).

3.8.2 Data collection reliability

Data from the biographical questionnaire, WAB (Kertesz, 1982) and comprehension items was captured on a Microsoft Excel spreadsheet. A post-graduate physiotherapist was asked to independently code and transfer 30% of the data into a Microsoft Excel spreadsheet. Percentage agreement (McMillan & Schumacher, 2010) was calculated to determine if the data was recorded accurately. Percentage agreement was calculated using the following formula:

$$\frac{Total\ number\ of\ agreements}{Total\ number\ of\ agreements + Disagreements}\ \mathrm{X}\ 100 = Percentage\ Agreement$$

$$\frac{80}{80+0}\mathrm{X}\ 100 = 100\ \%$$

Percentage agreement was 100%, which is considered excellent (McMillan & Schumacher, 2010).

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3.9. Data analysis

Biographical data and WAB (Kertesz, 1982) scores were captured on a Microsoft Excel spreadsheet, and descriptive statistics calculated. Data collected via the comprehension items was captured on a Microsoft Excel spreadsheet. Scores for each participant in each condition were compared and described. Descriptive statistics were computed for the responses to comprehension items across the two conditions (AI and no AI). Comparisons were made between the two conditions using repeated measures analysis of variance (ANOVA). 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 (Kertesz, 1982) and the number of accurate responses to comprehension items across the two conditions.

4. Results & Discussion

The results of the study are discussed according to the three sub-aims, namely, (i) accuracy of response during the AI condition; (ii) accuracy of response during the no AI condition; and (iii) comparisons between the AI and no AI conditions. In addition, individual analysis of (iv) participants' auditory comprehension difficulties, as determined by their scores on the auditory verbal comprehension subtest of the WAB (Kertesz, 1982), and response accuracy; and (v) response accuracy for each comprehension item for each of the narratives, is described.

4.1 Accuracy of responses during AI condition

In the AI condition, participants obtained an average response accuracy of 65.56%. The response accuracy scores during the AI condition ranged from 4–14 (M=9.83 SD=3.38). Figure 2 shows individual participation scores for the AI condition. Participants 5, 6, 7, 9 and 11 (n=5) had accuracy scores below the mean during the AI condition, while participants 1, 2, 3, 4, 8, 10, and 12 (n=8) had accuracy scores above the mean. Participant 8 had the most accurate responses during the AI condition; while participant 5 had the least accurate responses. Both these participants had mild Broca's Aphasia; however, participant 5 had a lower score on the auditory verbal comprehension subtest of the WAB (Kertesz, 1982). Those participants that scored below the mean, (except for participant 5 who had mild aphasia), had moderate aphasia (four participants); while those that scored above the mean had differing severities of aphasia (five with mild aphasia, one with moderate aphasia and one with

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severe aphasia). Table 8 shows participants' accuracy scores during the AI condition, WAB comprehension scores, as well as aphasia type and severity.

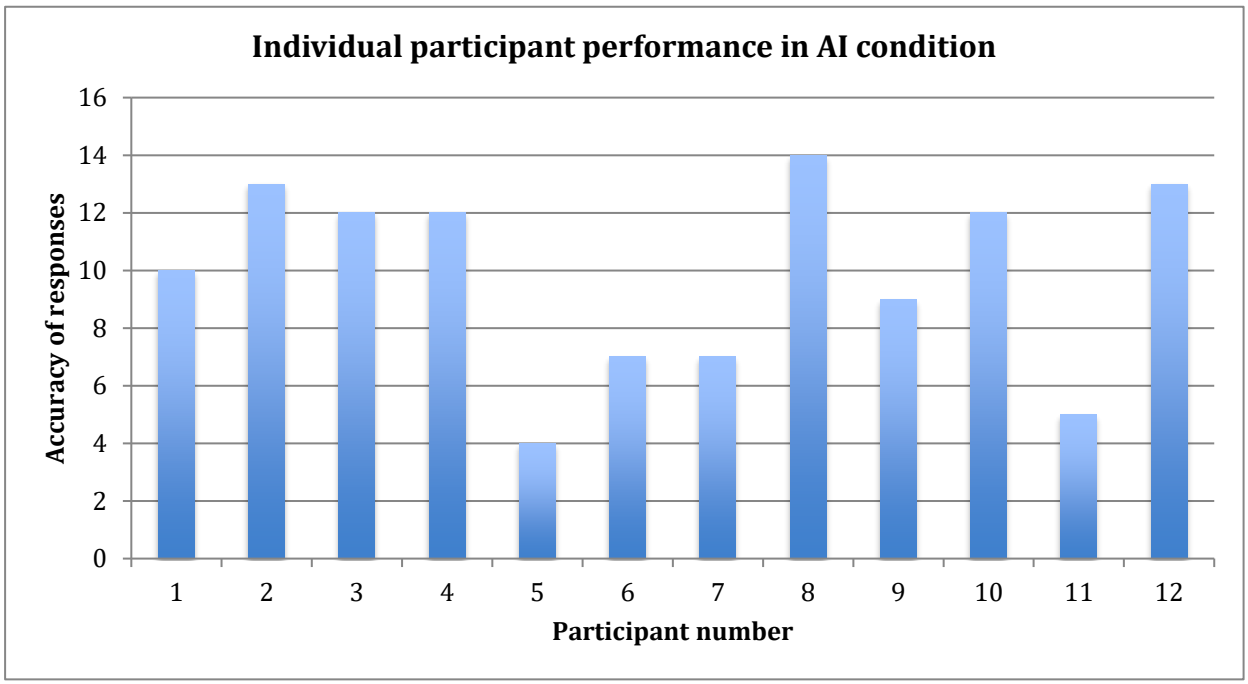

Figure 2. Individual participant performance in AI condition

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Table 8

Participants accuracy of responses during the AI condition, auditory comprehension score and WAB classification

Participant number	Number of accurate responses during AI condition	Auditory comprehension score	WAB classification
1	10	6.3	Mild Broca's Aphasia
2	13	8.25	Mild Broca's Aphasia
3	12	6.45	Mild Broca's Aphasia
4	12	8.1	Severe Broca's Aphasia
5	4	6.25	Mild Broca's Aphasia
6	7	7.2	Moderate Conduction Aphasia
7	7	5.5	Moderate Broca's Aphasia
8	14	7.65	Mild Broca's Aphasia
9	9	8.95	Moderate Broca's Aphasia
10	12	6.15	Moderate Broca's Aphasia
11	5	5.45	Moderate Broca's Aphasia
12	13	8.65	Mild Anomic Aphasia

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4.2 Accuracy of responses during no AI condition

In the no AI condition, participants obtained an average response accuracy of 56.67%. The response accuracy scores during the no AI condition ranged from 2–13 (*M*=8.50; *SD*= 3.18). Figure 3 shows individual participation scores for the no AI condition. Participants 1, 3, 5, 7, 10 and 11 (*n*=6) had accuracy scores of below the mean during the no AI condition, while participants 2, 4, 6, 8, 9, and 12 (*n*= 6) had accuracy scores above the mean. Participants 9 and 12 had the most accurate responses during the no AI condition; while participant 7 had the least accurate responses. Participant 9, who had the highest number of accurate responses, and participant 7, who had the lowest number of accurate responses, both had moderate Broca's Aphasia. Participant 12 had mild Anomic Aphasia. Participant 7 had the second lowest score on the auditory verbal comprehension subtest of the WAB (Kertesz, 1982) overall, and also scored the lowest number of accurate responses in both conditions, and amongst all participants. Of the participants that scored below the mean, three had mild aphasia and three had moderate aphasia; while those that scored above the mean had differing severities of aphasia (three with mild aphasia, two with moderate aphasia and one with severe aphasia). Table 8 shows participants' accuracy scores during the no AI condition, WAB comprehension scores, as well as

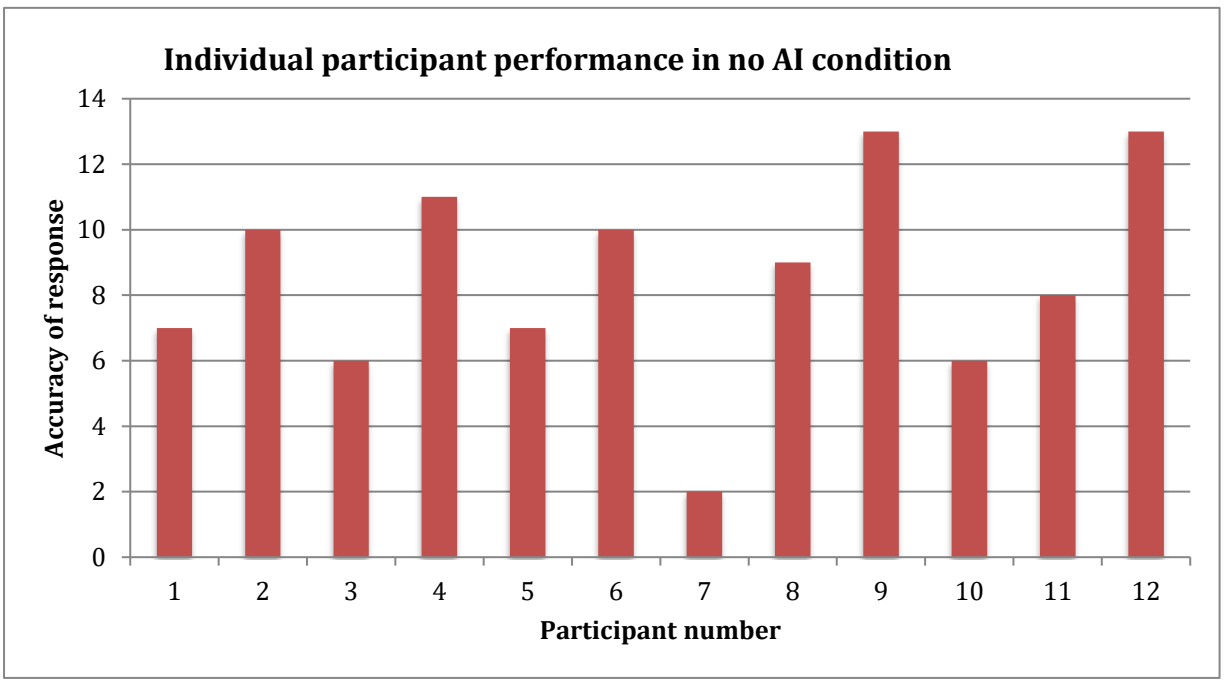

Figure 3. Individual participant performance in no AI condition

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aphasia type and severity.

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Table 9

Participants accuracy of responses during the no AI condition, auditory comprehension score and WAB classification

Participant number	Number of accurate responses during AI condition	Auditory comprehension score	WAB classification
1	10	6.3	Mild Broca's Aphasia
2	13	8.25	Mild Broca's Aphasia
3	12	6.45	Mild Broca's Aphasia
4	12	8.1	Severe Broca's Aphasia
5	4	6.25	Mild Broca's Aphasia
6	7	7.2	Moderate Conduction Aphasia
7	7	5.5	Moderate Broca's Aphasia
8	14	7.65	Mild Broca's Aphasia
9	9	8.95	Moderate Broca's Aphasia
10	12	6.15	Moderate Broca's Aphasia
11	5	5.45	Moderate Broca's Aphasia
12	13	8.65	Mild Anomic Aphasia

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4.3 Comparison between AI and no AI conditions

4.3.1 Descriptive statistics

The accuracy of responses to auditory comprehension tasks across the two conditions (AI and no AI) was compared and analysed. Participants received an average response accuracy of 61.11% across both narratives and conditions, (*M*=9.16; *SD*= 3.28)

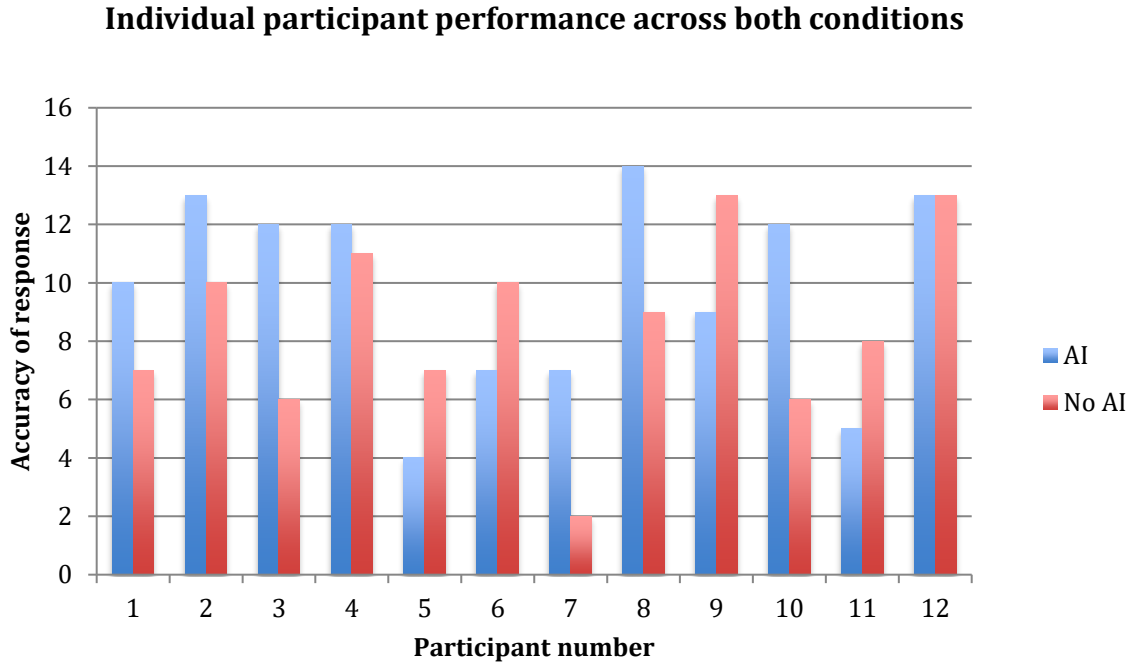

Figure 4. Individual participant performance across both condition

A total of seven participants (participants 1, 2, 3, 4, 7, 8 and 10) received higher accuracy scores in the AI condition, while four participants (participants 5, 6, 9, 11) received higher accuracy scores in the no AI condition. One participant (participant 12) received the same scores in both conditions. Figure 4 shows individual participant performance across the two conditions.

Of the seven participants who had a higher number of accurate responses to comprehension items in the AI condition, five had had exposure to AAC during their speech therapy intervention. This may have contributed to these participants benefitting more from the no context PCS images that were used as AI than the participants who did not have previous exposure to AAC.

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In order to achieve communicative competence when using any form of AAC, the person with complex communication needs has to develop and integrate sufficient knowledge, judgement and skills in terms of the linguistic, operational, social and strategic domains in order to utilise the AAC device or system effectively (Light & McNaughton, 2014). Linguistic competence is particularly important for this study as the participants would need to understand the language code of the AAC system, in this case the no context PCS images used as AI, in order to effectively benefit from it (Light & McNaughton, 2014). 71.43% of the participants who received higher accuracy scores in the AI condition had exposure to AAC prior to the study. Of the participants that did not benefit from the no context PCS images used as AI, 50% had not had any exposure to AAC before participating in the study. Existing literature suggests that simply providing an AAC system does not make individuals competent communicators; detailed instruction and training is essential for successful understanding and implementation of any AAC device or system (Beukelman & Mirenda, 2013).

4.3.2 Inferential statistics

Because the assumption of normality had been met, repeated measures ANOVA was conducted to compare the effect of the AI on auditory comprehension. The mean of the two conditions was not significantly different, $F(1, 11)= 1.4426$, $p= 0.25494$. Figure 5 depicts the mean for each of the conditions.

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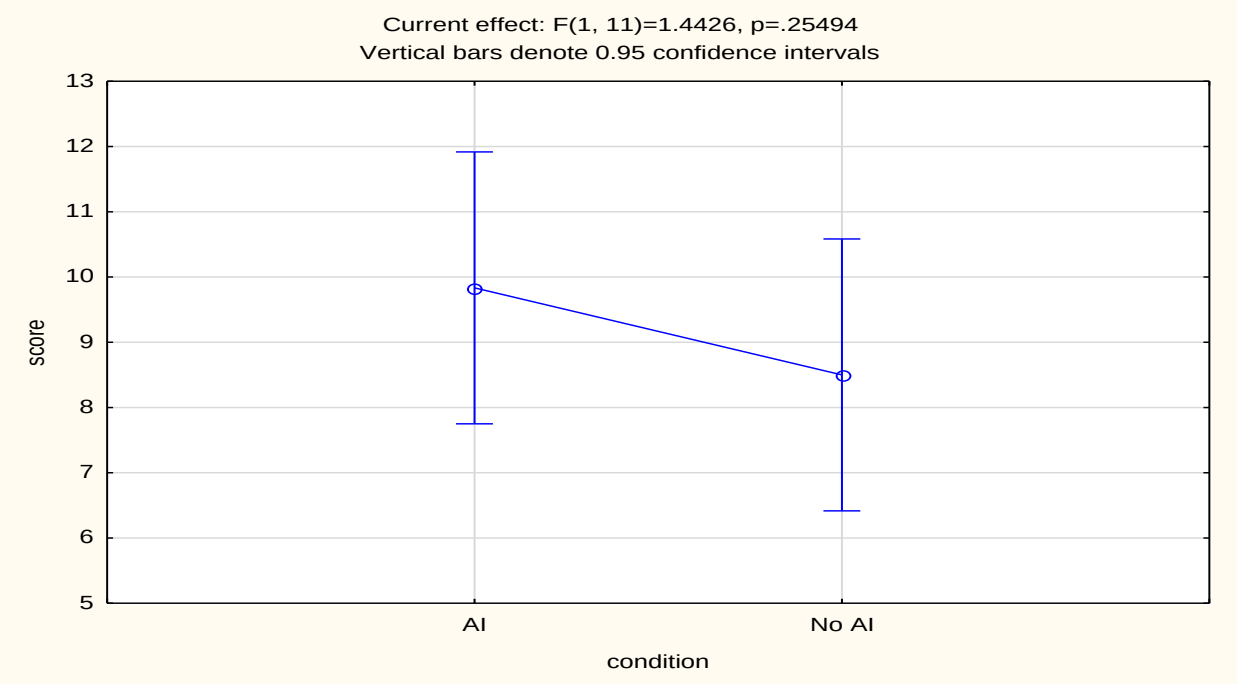

Figure 5. Mean for each condition

Two way ANOVA was conducted to determine if there were any carryover effects from the order of presentation of the condition. Results indicated that there were no carryover effects, F(1,10)= 0.33898, *p*= 0.57331.

4.4 Auditory comprehension difficulties and response accuracy

A significant difference was found between the participants that received AI first and those that received no AI first, *F*(1, 10)= 7.5188, *p*= 0.02076. That is, participants (2, 4, 6, 8, 10 and 12) that had the no AI condition first did significantly better overall in comparison to those participants (1, 3, 5, 7, 9 and 11) that had the AI condition first.

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The participants who had the no AI condition first had auditory verbal comprehension subtest scores on the WAB that ranged between 6.15–8.65 (*M*=7.67; *SD*=0.89); while those participants that had the AI first had auditory verbal comprehension subtest scores on the WAB that ranged from 5.5–8.95 (*M*=6.48; *SD*= 1.28). This was incidental and should have been controlled for.

This finding means that participants with less severe auditory comprehension difficulties performed more accurately in both conditions than those participants with more severe auditory comprehension difficulties. This finding is similar to that of Wallace et al. (2012), in which participants with milder aphasia performed more accurately than those participants with more severe ratings of aphasia.

Individual analysis did not reveal any patterns associated with the auditory verbal comprehension score on the WAB (Kertesz, 1982) and accuracy of responses to comprehension items between the two conditions. That is, some participants with more severe auditory comprehension difficulties did not benefit more from the AI, and at times had more accurate responses during the no AI condition. Similarly, those participants with milder auditory comprehension difficulties did not all respond more accurately in one of the conditions when compared to their responses in another condition. This finding is similar to previous research conducted by Brennan et al. (2005), Rose et al. (2011) and Wallace et al. (2012), in which no significant differences between different supports was found, and in which performance patterns across the different conditions was not related to independent variables such as aphasia severity. In order to determine a greater consistency in terms of what comprehension supports benefit persons with aphasia the most, research should aim to include only participants with the same types and severity of aphasia. (Dietz et al., 2014).

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4.5 Analysis of individual comprehension items

The comprehension items of each narrative were analysed to determine the percentage of correct and incorrect responses from each of the participants. The information for Narrative 1 is represented in Figure 6, and for Narrative 2 in Figure 7.

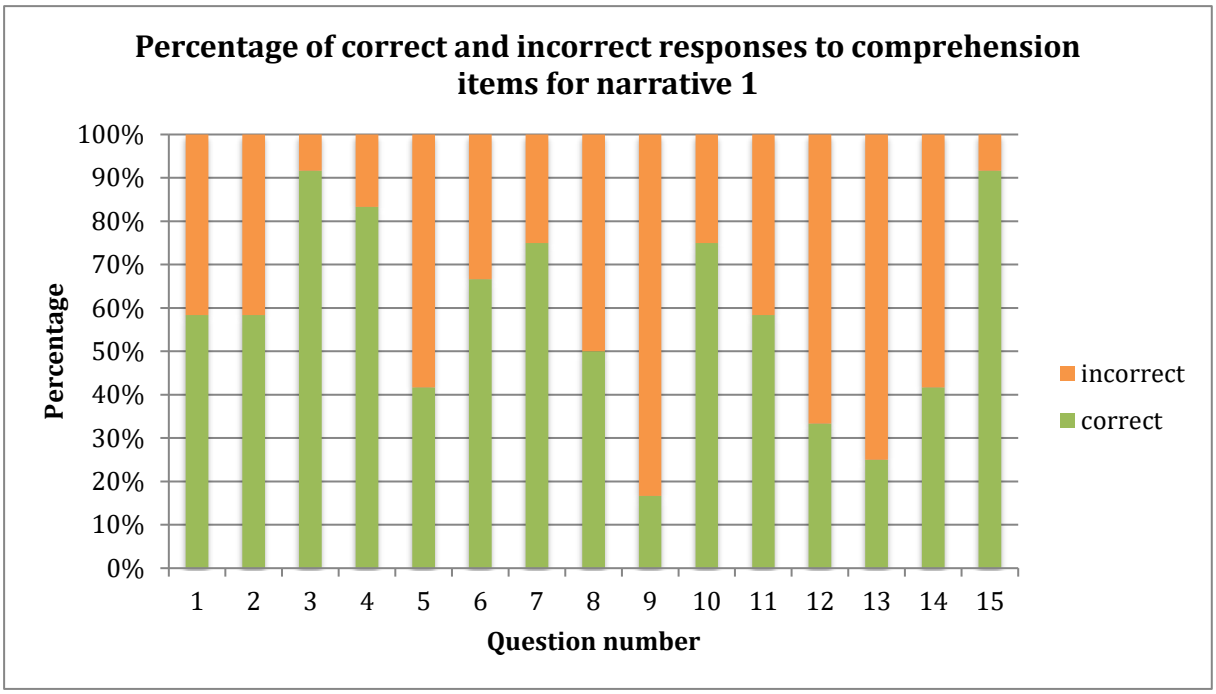

Figure 6. Responses to each comprehension items for Narrative 1

During the comprehension items related to Narrative 1, the majority of participants answered nine comprehension items correctly and five items incorrectly. This corresponded to items 1, 2, 3, 4, 6, 7, 10, 11 and 15 which were answered correctly by the majority of participants; while the majority of participants responded inaccurately to items 5, 9, 12, 13, and 14. The number of incorrect and correct responses to comprehension item 8 was equal.

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 15 (*n*=5) were considered inferential questions. The majority of participants responded accurately to 70% of the factual comprehension items, while the majority of participants responded accurately to 40% of the inferential items.

During the comprehension items related to Narrative 2, the majority of participants answered 11 comprehension items correctly and three comprehension items incorrectly. This corresponded to items 1, 2, 4, 6, 7, 8, 9, 10, 11, 12 and 14

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answered correctly by the majority of participants; while the majority of participants responded inaccurately to items 3, 5, and 13. The number of incorrect and correct responses to comprehension item 15 was equal.

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. The majority of participants responded accurately to 80% of the factual comprehension items, while the majority of participants responded accurately to 20% of the inferential items.

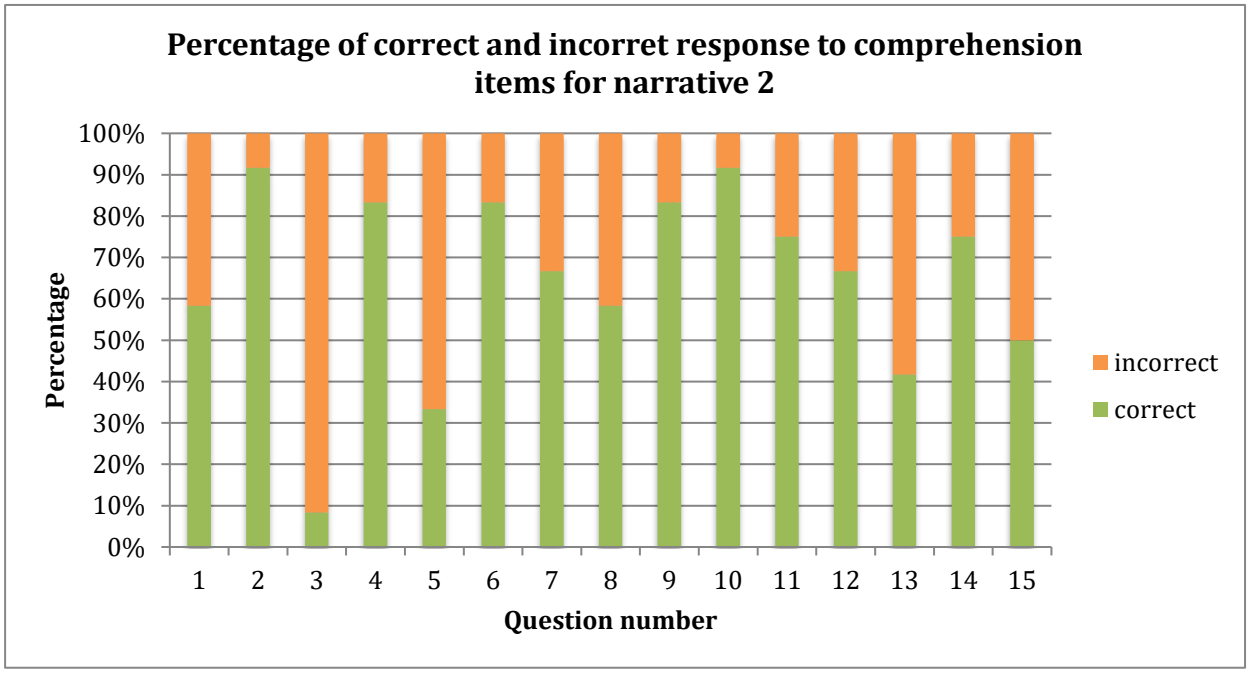

Figure 7. Responses to each comprehension items for Narrative 2

Similar findings were apparent in the study by Wallace et al. (2014) in which it was found that persons with aphasia performed with the poorest accuracy when selecting images related to the inferential sentence stimuli. Persons with aphasia performed with the greatest accuracy during the main action sentence stimuli. Both the present study and that conducted by Wallace et al. (2014) highlight the need for continued research into what forms of support can facilitated improved comprehension of inferential information for persons with chronic aphasia.

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5. Conclusion

In this study, the effect of AI on auditory comprehension for persons with chronic aphasia was investigated. The research was conducted by having participants listen to two narratives in two different conditions, namely AI and no AI, and then respond to comprehension items based on the narratives. The number of accurate responses for each of the conditions was calculated, and the two conditions were compared. A summary of the most salient information is presented, followed by the clinical implications of the study. The study is then evaluated in terms of its strengths and limitations, after which recommendations for future research are explored.

5.1 Summary of main findings

This study represents a preliminary step to investigate how AI can facilitate auditory comprehension of narratives for persons with chronic aphasia. In an attempt to determine the effect of AI on the auditory comprehension of narratives for persons with chronic aphasia the study examined (i) the accuracy of responses to auditory comprehension items during the AI condition; (ii) the accuracy of responses to auditory comprehension items during the no AI condition; and (iii) a comparison of the accuracy of responses on the auditory comprehension items between the AI and no AI conditions.

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 two conditions; however, the majority of participants (58.33%) had more accurate scores during the AI condition. The lack of significant findings may be related to the small sample size.

5.2 Clinical implications

The main clinical implication is that supporting narrative auditory comprehension tasks with high context images and no context PCS images as a form of AI, used as pre-task and during task stimulation, seems to facilitate the improved auditory comprehension of narratives for some persons with chronic aphasia.

In addition, the results of this study suggest that more prior exposure to AAC or picture communication during speech therapy sessions may facilitate improved auditory comprehension during the AI condition. Previous research suggests that

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sufficient knowledge, judgement and skills are imperative in AAC use (Light & McNaughton, 2014), and this can only be achieved by providing ample opportunities for those persons who require AAC to practise the skills needed in order to become competent communicators (Light & McNaughton, 2014).

5.3 Evaluation of the study

5.3.1 Strengths

One of the major strengths of this study is that it is the first study that focused on the effect of providing AI at a frequency of 70% on auditory comprehension of narratives for persons with chronic aphasia. The design that was used allowed for comparisons between the two conditions, and the alternation of narratives and conditions across participants controlled for order and carryover effects (Barlow & Hayes, 1979). The study also made use of pre-task stimulation, which recent literature has suggested is an important factor to consider during comprehension tasks as it is believed to activate prior knowledge and allow the person to allocate resources more successfully to the task (Dietz et al., 2014). Another strength is the fact that some of the materials used in this study, which included the high context images, narratives, and comprehension items, were previously used in a peer-reviewed published article (Wallace et al., 2012). The use of scripts throughout the study ensured that data collection was the same for each participant, which therefore heightened procedural integrity.

5.3.2 Limitations

The limitations of the study included a small sample size, as only 12 persons with aphasia participated in the study. The study targeted a very specific population of adults with aphasia, with strict selection criteria, which made participant recruitment a challenge. Therefore, the results of this study have limited generalizability. This study also included participants with various types and severities of aphasia, and this may have influenced the results.

Another limitation of the study was the fact that participants who had the no AI condition first had a significantly higher number of accurate responses to comprehension items overall than those participants that had the AI condition first. Those participants that were in the no AI condition first had a higher average score on the auditory verbal comprehension subtest of the WAB (Kertesz, 1982) than those

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participants that had the AI condition first. This factor should have been controlled for.

5.4 Recommendations for future research

A number of recommendations for future research are evident from this study:

- This study could be replicated with a larger sample of adults with chronic aphasia in order to generalize the findings to the wider population of adults with aphasia.
- This study could be replicated using participants with the same aphasia type and severity to determine what forms of AI best support differing types and severities of aphasia.
- To investigate differing frequencies of AI and the effect this has on auditory comprehension for persons with chronic aphasia
- To investigate the use of real photographs, rather than no context PCS images, used as AI, and the effect this has on auditory comprehension.

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7. Appendices

Appendix A: Permission letter to private practice owner

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UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

PERMISSION LETTER TO PRIVATE PRACTICE OWNERS

Dear Sir/Madam

REQUEST FOR PERMISSION TO RECRUIT PARTICIPANTS FOR MASTERS RESEARCH FROM YOUR PRACTICE

My name is Nicola Stockley. I am a speech-language therapist and I am currently enrolled for a Masters 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.

My research project is entitled: "the effect of augmented input on the auditory comprehension of narratives for persons with chronic aphasia". The study aims to determine the effect of augmented input on the accuracy of responses to an auditory comprehension task based on a narrative, for persons with chronic aphasia.

Augmented input (AI) refers to any visual or linguistic strategy used by the communication partner to increase the message comprehension of an individual with aphasia (Garrett & Lasker, 2005; Wallace et al., 2012; Wood, Lasker, Siegel-Causey, Beukelman & Ball, 1998). This strategy of AI is believed to support the auditory comprehension of messages by increasing the saliency of the information presented by the communication partner (Wallace et al., 2012).

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 a venue that is convenient for the participant and their family. The participants will be met individually on 1 day.

The study aims to recruit a minimum of 8 individuals with chronic aphasia following a left CVA, along with a significant other (family member or friend) that can assist with explaining the procedures to the participant and completing the consent process.

In order to participant in this study, potential participants should comply with the following criteria:

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
wwwcaac.up.ac.za

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

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- Have aphasia secondary to a left CVA
- Mild-moderate auditory comprehension difficulty
- Chronic aphasia (stroke 6 months ago or more)
- Be proficient in English
- No history of premorbid cognitive or language difficulties
- Normal or correct vision
- Normal or corrected hearing
- Have a significant other

Should you give permission for me to recruit participants from your practice, I will need your assistance to identify those persons that meet the criteria. If you know of any persons that may fit the criteria, please ask their permission to provide me with their contact details. Once a list of names and contact details has been provided, the potential participants and significant others will be contacted directly by the researcher and asked if they are willing to participate.

If they are, they will be provided with a letter of information. Informed consent will be obtained by explaining the purpose, expected duration and procedure of the study to both participants and their significant others. They will be informed that participation in the study is voluntary, that that they can withdraw from the study at any time without consequence, and that any data pertaining to them will be immediately destroyed if they wish to withdraw. Additional actions will be taken to ensure that persons with aphasia have the opportunity to give informed consent without being coerced. This includes writing the information in simple English and including visual aids to enhance understanding. The significant other will be present to observe the person with aphasia give their consent, and is requested to ensure that the person with aphasia understands the study and gives consent without being coerced. Owning to the fact that persons with aphasia may have reduced comprehension, consent will also be obtained from the significant other.

The results of the study are intended to be published in the format of a Masters Mini Dissertation, and possibly in a publication and conference. The practice's name, as well as participants' and significant others' names, 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 AAC at the University of Pretoria for 15 years for the purpose of archiving.

The involvement of the participants in this study will entail:

- Interested participants and their significant others will be contacted to arrange a meeting. Research will be conducted at a venue that is convenient to the participant and their family.
- During this meeting, consent will be obtained from the participant and their significant other. I will ask the significant others to observe how I explain the study to the participant and ensure that he/she understands it, and to ensure that the individual is not being coerced into participating.

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- Should the individuals provide consent, the biographical questionnaire, Western Aphasia Battery, visual perceptual skills screening and Written Choice screening procedure will be completed. This will take approximately 1 hour.
- The participant and their significant other will then be offered a short comfort break.
- The experimental task will then be completed. During the tasks, the participants will be read 2 narratives, 1 with augmented input and 1 with no augmented input, and required to answer questions based on the narratives. During these experimental tasks participants will be video-recorded to check for treatment integrity. Only the researcher, research assistant and the research supervisor will view these recordings. The experimental tasks will take approximately half an hour.

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

Yours sincerely

Nicola Stockley	**Shakila Dada**	**Date**
Researcher	**Supervisor**	

[redacted]

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PERMISSION 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: Nicola Stockley

Signature…….. Date……

Place……..

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Appendix B: Permission letter to hospital manager

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

PERMISSION LETTER TO HOSPITAL MANAGER

Dear Sir/Madam

Request for permission to recruit participants for Masters research from hospital

My name is Nicola Stockley. I am a speech-language therapist and 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.

My research project is entitled: "the effect of augmented input on the auditory comprehension of narratives for persons with chronic aphasia". The study aims to determine the effect of augmented input on the accuracy of responses to an auditory comprehension task based on a narrative, for persons with chronic aphasia.

Augmented input (AI) refers to any visual or linguistic strategy used by the communication partner to increase the message comprehension of an individual with aphasia (Garrett & Lasker, 2005; Wallace et al., 2012; Wood, Lasker, Siegel-Causey, Beukelman & Ball, 1998). This strategy of AI is believed to support the auditory comprehension of messages by increasing the saliency of the information presented by the communication partner (Wallace et al., 2012).

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

In order to participant in this study, potential participants should comply with the following criteria:

- Have aphasia secondary to a left CVA
- Mild-moderate auditory comprehension difficulty
- Chronic aphasia (stroke 6 months ago)
- Be proficient in English
- No history of premorbid cognitive or language difficulties
- Normal or correct vision
- Normal or corrected hearing
- Have a significant other

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The study aims to recruit a minimum of 8 persons with chronic aphasia following a left CVA, 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 participants and their significant others. Additional actions will be taken to ensure that the persons with aphasia have the opportunity to give informed consent without being coerced. This includes writing the information in simple English and including visual aids to enhance understanding. The significant other will be present to observe the person with aphasia give their consent, and is requested to ensure that the person with aphasia understands the study and gives consent without being coerced. Owning to the fact that persons with aphasia may 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 consequence.

The participants will be met individually, with their significant other, on 1 occasion. During the meeting, the purpose of the study will be discussed and informed consent obtained, as well as the administration of the Western Aphasia Battery, visual perceptual skills screening test and Written Choice Strategy screening test. This will take approximately 1 hour. Following this, the participant and their significant other will be offered a short comfort break. The experimental tasks will be done after this.

During the experimental condition, participants will be read 2 narratives; 1 with no augmented input and 1 with augmented input, and 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, research 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 their participation.

Should you give permission, the potential participants will be identified by the researcher. Those persons that meet the criteria will be asked if they are willing to participant in the study and will be provided with an information letter. The information letter details the purpose and nature of the study, the fact that participation in the study is voluntary, that participants can withdraw from the study at any time without consequence, and that any data pertaining to them will be immediately destroyed if they choose to withdraw. Interested individuals, who meet the inclusion criteria, will then be requested to provide the researcher with contact details. These individuals and their significant others will be contacted directly by the researcher to arrange the meeting in which the research will take place.

The results of the study are intended to be published in the format of a Masters Mini dissertation, and possibly in a publication and conference. The participants' and significant others' names, 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 AAC at the University of Pretoria for 15 years for the purpose of archiving.

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

Yours sincerely

Nicola Stockley	Shakila Dada	Date
Researcher	Supervisor	

[redacted]

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PERMISSION LETTER FROM HOSPITAL MANAGER

I …….. as the hospital 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: Nicola Stockley

Signature…….. Date……

Place……..

Hospital Stamp

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Appendix C: Permission letter to Non-Government Organization

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

PERMISSION LETTER TO NON-GOVERNMENT ORGANIZATIONS

Dear Sir/Madam

REQUEST FOR PERMISSION TO RECRUIT PARTICIPANTS FOR MASTERS RESEARCH FROM NGO

My name is Nicola Stockley. I am a speech-language therapist and 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.

My research project is entitled: "the effect of augmented input on the auditory comprehension of narratives for persons with chronic aphasia". The study aims to determine the effect of augmented input on the accuracy of responses to an auditory comprehension task based on a narrative, for persons with chronic aphasia.

Augmented input (AI) refers to any visual or linguistic strategy used by the communication partner to increase the message comprehension of an individual with aphasia (Garrett & Lasker, 2005; Wallace et al., 2012; Wood, Lasker, Siegel-Causey, Beukelman & Ball, 1998). This strategy of AI is believed to support the auditory comprehension of messages by increasing the saliency of the information presented by the communication partner (Wallace et al., 2012).

I would like to request your permission to recruit suitable participants from your non-government organization (NGO) for my study described below.

In order to participant in this study, potential participants should comply with the following criteria:

- Have aphasia secondary to a left CVA
- Mild-moderate auditory comprehension difficulty
- Chronic aphasia (stroke 6 months ago)
- Be proficient in English
- No history of premorbid cognitive or language difficulties
- Normal or correct vision
- Normal or corrected hearing
- Have a significant other

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The study aims to recruit a minimum of 8 persons with chronic aphasia following a left CVA, 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 participants and their significant others. Additional actions will be taken to ensure that persons with aphasia have the opportunity to give informed consent without being coerced. This includes writing the information in simple English and including visual aids to enhance understanding. The significant other will be present to observe the person with aphasia give their consent, and is requested to ensure that the person with aphasia understands the study and gives consent without being coerced. Owning to the fact that persons with aphasia may 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 consequence.

The participants will be met individually, with their significant other. During this meeting, the purpose of the study will be discussed and informed consent obtained, as well as the administration of the Western Aphasia Battery, visual perceptual skills screening test and Written Choice Strategy screening test. This will take approximately 1 hour. Following this, a short comfort break will be offered to the person with aphasia and their significant other.

The experimental condition will then begin. During the experimental condition, participants will be read 2 narratives; 1 with no augmented input and 1 with augmented input, and required to answer questions based on the narratives. These experimental sessions will be video-recorded to check for treatment integrity. Only the researcher, research assistant and the research supervisor will view these recordings. This will take approximately half an hour. Participants will receive a small token of appreciation at the end of the study to thank them for their participation.

Should you give permission, the researcher will arrange a visit to the NGO during one of the stroke support groups and provide potential participants with information (written and verbal) on the study. The information letter details the purpose and nature of the study, the fact that participation in the study is voluntary, that participants can withdraw from the study at any time without consequence, and that any data pertaining to them will be immediately destroyed if they choose to withdraw. Interested individuals, who meet the inclusion criteria, will then be requested to provide the researcher with contact details. These individuals and their significant others will be contacted directly by the researcher to arrange a meeting.

The results of the study are intended to be published in the format of a Masters Mini Dissertation, and possibly in a publication and conference. The participants' and significant others' names, 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 AAC at the University of Pretoria for 15 years for the purpose of archiving.

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

Yours sincerely

Nicola Stockley	**Shakila Dada**	**Date**
Researcher	**Supervisor**	

[redacted]

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PERMISSION LETTER FROM NON-GOVERNMENT ORGANIZATION

I . 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: Nicola Stockley

Signature .. Date

Place ..

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Appendix D: Information letter for person with aphasia

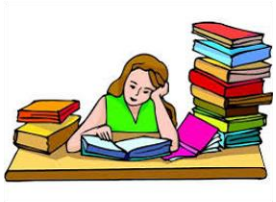
UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

Dear Sir/Madam

REQUEST TO PARTICIPATE IN RESEARCH STUDY

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



My name is Nicola Stockley. I am a speech therapist. I am busy studying for a Masters degree in Augmentative and Alternative Communication (AAC) through the University of Pretoria. I am doing a study to find out if pictures help you understand stories better.

I would like you to help me to better understand how people can assist you to understand instructions and stories better.

Your participation in this study is voluntary. You can pull out (withdraw) from the study at any time with no consequence. Participating in this study will bring you no harm.

If you want to take part in the study, all the information will be treated confidentially. No one will know that it was you that gave me any information. All the information you give me will be stored for 15 years at the Centre for AAC at the University of Pretoria.

I will meet with you and your family member/friend/carer (significant other). I will ask you to fill in some information about yourself. Your significant other can help you with this.

I will also do some assessments with you to see what type of language difficulty you have, if your see things accurately, and if you can answer questions in a particular way that is needed for this study. This will take about one hour. It will take place in a quiet room. If you are unable to answer these questions in the particular way that is needed for the experimental tasks, then we will not move onto the experimental tasks. This is only for the purposes of this study. It does not mean that you will not get better.

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I will read you two stories. You will have to answer some questions on the story.

I will video-record us together doing these tasks. This will take about half an hour. The video-recording we made will be used for research purposes only.

The results of the study are intended to be published in the format of a Masters Mini Dissertation, as well as possibly in a publication format and at a conference. Your name will not be used in the dissertation, publication or conference.

If at any time during data collection you change your mind about being in the study, you can ask to stop and all information about you will be immediately destroyed.

You will receive a small token of appreciation at the end of our time together.

I would appreciate your consideration of my request. You can contact me with any questions or queries you have on the details supplied below.

Yours sincerely

Nicola Stockley **Researcher**	**Shakila Dada** **Supervisor**	**Date**

[redacted]

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Appendix E: Information letter for significant other

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

LETTER OF INFORMATION FOR SIGNIFICANT OTHER

Dear Sir/Madam

REQUEST TO PARTICIPATE IN A RESEARCH STUDY

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

My name is Nicola Stockley. I am a speech-language therapist and I am currently enrolled for a Master's degree in Augmentative and Alternative Communication (AAC) at the University of Pretoria.

My research project is entitled: "the effect of augmented input on the auditory comprehension of narratives for persons with chronic aphasia". The study aims to determine the effect of augmented input on the accuracy of responses to an auditory comprehension task based on a narrative, for persons with chronic 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.

As a person who is a friend/family member of an individual with aphasia, I would like to request your help in participating in the study.

Participation in this study is voluntary, and you may withdraw from the study at any time without any consequence. All information will be treated confidentially. Participants who express an interest to participate in the study will be met by the researcher at a place that is convenient for them. 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 family member/friend with aphasia, and ensure that they understand it. I would also like you to ensure that I am not coercing your family member/friend to participate in the study.

Should you provide consent, you will also be asked to complete, or help your family member/friend with aphasia to complete the biographical questionnaire. This should take about 5-10 minutes. After this, your family member/friend will have some screening assessments done. This will take 1 hour. Your family member/friend 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 tasks. If the participant does not score the required points, they will not continue with experimental task. This does not mean that there is no hope for recovery for your family member/friend; it is just for the purposes of

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this study as participants need to be as similar as possible in order to make the results as valid as possible.

If your family member/ friend has the required sores during the screening procedures, the experimental condition will begin. This will entail your family member/friend with aphasia listening to two 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.

The results of the study are intended to be published in the format of a Masters dissertation, and possibly a publication and conference. Your name, as well as the name of your family member/friend 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 AAC at the University of Pretoria for 15 years for the purpose of archiving. Should you wish to withdraw from the study, any data pertaining to you will be immediately destroyed.

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

Nicola Stockley
Researcher

Shakila Dada **Date**
Supervisor

[redacted]

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Appendix F: Letter of consent from person with aphasia

UNIVERSITEIT VAN PRETORIA
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Faculty of Humanities

CONSENT LETTER FOR PERSON WITH APHASIA

Project title

The effect of augmented input on the auditory comprehension of narratives for persons with chronic aphasia

Have you read the information sheet, or had it explained to you?

YES **NO**

Have you had time to ask questions about the study?

YES **NO**

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Do you understand that it is your choice to participate in the study?

YES **NO**

Do you understand that you will be video-recorded during the study?

YES **NO**

Do you understand that you can stop at any time during the study? You do not have to say why you want to stop.

YES **NO**

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Do you want to take part in this study?

YES

NO

Name

Signature .. Date

Place .

Researcher: Nicola Stockley

Signature .. Date

Place ..

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Appendix G: Letter of consent from significant other

UNIVERSITEIT VAN PRETORIA
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Faculty of Humanities

CONSENT LETTER FOR SIGNIFICANT OTHER

Project title

The effect of augmented input on the auditory comprehension of narratives for persons with chronic aphasia

I ..... as the significant other of

..... have read and understood the information

pertaining to the study and give consent to take part in the study.

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

Place.....

Researcher: Nicola Stockley

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

Place.....

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

Appendix H: Biographical questionnaire

Please complete this form

For Official Use

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
	Tshivenda
	Xitsonga

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☐ other

Other: Please specify _____

5. **What is your highest level of education?**

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

Other: Please specify _____

6. **What was your occupation?** (please specify)

_____

7. **What is your marital status?**

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

Other: Please specify _____

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

☐ Left
☐ Right

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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

Please specify _____

11. Do you have any problems with your vision?

	Yes
	No

12. if so, do you wear spectacles?

	Yes
	No

13. Do you have any problems with your hearing?

	Yes
	No

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

	Yes
	No

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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

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

- ☐ Yes
- ☐ No

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?**

_____

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22. Have you been exposed to any AAC or picture communication in speech therapy?

	Yes
	No

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Appendix I: Western Aphasia Battery

Participant number	

WESTERN APHASIA BATTERY

1. SPONTANEOUS SPEECH

Record patients speech on paper and tape. Substitute similar questions if necessary/appropriate. Score fluency and information content according to criteria on page 3

1. How are you today?

_____

2. Have you been here before?

_____

3. What is your name?

_____

4. What is your address?

_____

5. What is your occupation?

_____

6. Tell me a little about why you are here? Or what seems to be the trouble?

_____

_____

7. Description of picture

Present test picture (Card1) and say: 'Tell me what you see. Try to talk in sentences, encourage the patient to pay attention to all aspects of the picture. Move the picture towards the patients intact visual field. Ask for more complete response if only a few words are produced.

FLUENCY _____ **INFORMATION** _____ **TOTAL** _____

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2. AUDITORY VERBAL COMPREHENSION

Explain to the patient that you are going to ask some questions and that the answers should be either 'yes' or 'no'

If it is difficult to establish a consistent verbal or gestural yes response, then eye closure for 'yes' should be established. The instructions should be repeated, if necessary, during the test. Reinforce the patient when he or she gets into answering as requested, but avoid nodding or commenting on specific items! If the patient self-corrects, the last answer is scored. If a patient gives an ambiguous response, repeat the instructions and the question and score

A. Yes/No responses:

		Verbal	Gesture	Eye blink
1	Is your surname Smith?	_____	_____	_____
2	Is your surname Brown?	_____	_____	_____
3	Is your surname …….?	_____	_____	_____
4	Do you live in Toronto?	_____	_____	_____
5	Do you live in …….?	_____	_____	_____
6	Do you live in Winsor?	_____	_____	_____
7	Are you a man/woman?	_____	_____	_____
8	Are you a doctor?	_____	_____	_____
9	Are you a man/woman?	_____	_____	_____
10	Are the lights on in this room?	_____	_____	_____
11	Is the door closed?	_____	_____	_____
12	Is this a hotel?	_____	_____	_____
13	Is this ...(test real location)?	_____	_____	_____
14	Are you wearing read pajamas?	_____	_____	_____
15	Will paper burn in fire?	_____	_____	_____
16	Does March come before July?	_____	_____	_____

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17	Can you eat a banana before you peel it?	_____	_____	_____
18	Does it snow here in October?	_____	_____	_____
19	Is a horse bigger than than a dog?	_____	_____	_____
20	Do you cut grass with an ax?	_____	_____	_____

TOTAL

_____ **/ 60**

B. Auditory word recognition

Place the real objects in a random cluster making sure that they are within the patients entact field if hemanopsia is present.

Present cards of the pictured objects, forms, letters, numbers, and colors. Ask the patient to point to the furniture, his or her body parts, and fingers, in the order listed. Ask the patient to point to each item, by saying, ' Point to the _____ or, 'show me the ___' One repetition of each command is allowed.

If the patient points to more than one item, score 0, unless it is clear that the patient recognizes his or her error and corrects it. For the seven items requiring left-right discrimination, the patient must get both the side and body part coorrect to receive credit. If the room does not have certain furniture, substitute comparable items.

OBJECTS	DRAWN OBJECTS	FORMS	LETTERS	NUMBERS
Cup	Matches	Square	J	5
Matches	Cup	Triangle	F	61
Pencil	Comb	Circle	B	500
Flower	Skrewdriver	Arrow	K	1867
Comb	Pencil	Cross	M	32
Skrewdriver	Flower	Cylinder	D	5000

COLORS	FURNITURE	BODYPARTS	FINGERS	RIGHT-LEFT
Blue	Window	Ear	Thumb	R-shoulder
Brown	Chair	Nose	Ring finger	L-knee
Red	Table	Eye	Index finger	L-ankle
Green	Light	Chest	Little finger	R-wrist
Yellow	Door	Neck	Middle finger	L-elbow
Black	Ceiling	Chin	R - ear	R-cheek

TOTAL _____ **/ 60**

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C. Sequential commands

Score for partial execution of the commands according to the numbers above each segment that is correctly executed. If the patient requests repetition or looks confused, repeat the command as a full sentence. On the table before the patient line up the pen, comb, and book in this respective order and label each, verbally: 'See the pen, the comb and the book? I will ask you to point to them and do things with them, just as i say. Are you ready?' If the patient does not seem to understand the task, point with the comb to the pen to demonstrate, and start again.

1	Raise your hand	2
2	Shut your eyes	2
3	Point to the chair	2
4	Point to the window and then to the door	4
5	Point to the pen and the book	4
6	Point with the pen to the book	8
7	Point to the pen with the book	8
8	Point to the comb with the pen	8
9	With the book point to the comb	8
10	Put the pen on top of the book and then give it to me	14
11	Put the comb on the other side of the pen and turn the book over	20

TOTAL _____ **/ 80**

TOTAL: ____**/60 +** ____**/60 +** ____**/80 =** ____**/200**

3. Repetition

Ask the patient to repeat the words listed below, then record the responses. You may repeat items one time, if the patient asks or does not seem to hear.

If the item is only incompletely repeated, score 2 points for each recognizable word. Minor dysarthric errors or colioqual pronuncation are scored as correct. Take 1 point off for errors in oder of word sequence or for each literal paraphasia (phonemic errors).

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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	5
9	Sixty-two and a half	5
10	The telephone is ringing	10
11	He is not comming back	10
12	The pastry cook was elated	8
13	First British Field Artillery	12
14	No ifs, ands or buts	12
15	Pack my box with five dozen jugs of liquid veneer	18

TOTAL _____ **/ 100**

4. NAMING

A. Object naming:

Present objects in the order listed below. If no or incorrect responses to visual stimulus let the patient touch the stimulus. If still no or incorrect responses, present a phonemic or, a composite word, a semantic cue the first half of the word. Allow a maxumum of 20 seconds for each item.

If named correctly or with minor articulatory errors *3 points*
For a recognizable phonemic paraphasia *2 points*
If a phonemic or tactile cue is required *1 points*

STIMULUS	RESPONSE	TACTILE	PHONEMIC	SCORE

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			CUE		CUE	
1	Gun	_____	_____	_____	_____	
2	Ball	_____	_____	_____	_____	
3	Toothbrush	_____	_____	_____	_____	
4	Knife	_____	_____	_____	_____	
5	Cup	_____	_____	_____	_____	
6	Eraser	_____	_____	_____	_____	
7	Comb	_____	_____	_____	_____	
8	Spoon	_____	_____	_____	_____	
9	Matches	_____	_____	_____	_____	
10	Pencil	_____	_____	_____	_____	
11	Razor	_____	_____	_____	_____	
12	Screwdriver	_____	_____	_____	_____	
13	Watch	_____	_____	_____	_____	
14	Key	_____	_____	_____	_____	
15	Glasses	_____	_____	_____	_____	
16	Scissors	_____	_____	_____	_____	
17	Screw	_____	_____	_____	_____	
18	Straw	_____	_____	_____	_____	
19	Soap	_____	_____	_____	_____	
20	Lock	_____	_____	_____	_____	

TOTAL _____ **/ 60**

B. Wordfluency:

Ask the patient to name as many animals as the or she can in 1 minute. The patient may be helped if hesitant: 'Think of a domestic animal, like the horse, or a wild animal, like the tiger' the patient may be prompted at 30 seconds. Score 1 point for each animal named (exept for those in the example), even if distorted by literal paraphasia.

1	_____	11	_____
2	_____	12	_____
3	_____	13	_____
4	_____	14	_____
5	_____	15	_____
6	_____	16	_____
7	_____	17	_____
8	_____	18	_____

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9	_____	19	_____
10	_____	20	_____

TOTAL _____ **/ 20**

C. Sentence Completion:

Ask the patient to complete what you say. Provide an example, such as 'ice is cold'.

Correct response *2 points*
Phonemic paraphasias *1 points*

1	The grass is	_____	Green
2	Sugar is	_____	White
3	Roses are red, violets are	_____	Blue
4	They fought like cats and	_____	Dogs
5	Christmas is in the month of	_____	December

TOTAL _____ **/ 10**

D. Responsive speech:

Score: *Acceptable responses* *2 points*
Phonemic paraphasias *1 points*

1	What do you write with?	_____	Pen/pencil
2	What color is snow?	_____	White
3	How many days are there in a week?	_____	Seven
4	Where do nurses work?	_____	Hospital
5	Where can you buy stamps?	_____	Post Office

TOTAL _____ **/ 10**

TOTAL: ____**/60 +** ____**/20 +** ____**/10 +** ____**/10 =** ____**/100**

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Participant number	

Appendix J: Visual Perceptual Skills screening test

VISUAL PERCEPTUAL SKILLS SCREENING TEST

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

dog

river

book

water

cloud

water

wild

log

name

pen

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Participant number	

Appendix K: Written Choice Strategy screening test

WRITTEN CHOICE STRATEGY SCREENER

1. You wash with…

coffee

banana

soap

toilet

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2. You write with a…

pen

toe

apple

dog

© University of Pretoria

3. You sit on a…

toothbrush

chair

orange

cat

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4. You tell time with a…

baby

road

watch

house

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Appendix L: High context photograph (1)

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Appendix M: High context photograph (2)

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Appendix N: Narrative 1

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.

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Appendix O: Narrative 2

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.

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Appendix P: Augmented input condition (1)

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Appendix Q: Augmented input condition (2)

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Appendix R: Expert in AAC feedback

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UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities

Dear Colleague,

Thank you very much for agreeing to participate in this review panel. Your time and expertise is 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. All your answers will remain confidential.

If you have any questions, please feel free to contact me.

Yours sincerely

Nicola Stockley
Researcher

Shakila Dada
Supervisor

[redacted]

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

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

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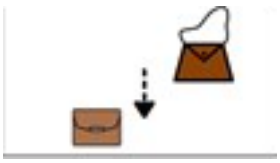
Narrative 1

Symbol	Rating	Comment/suggestion
shopping 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
Mrs. White 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
purse fell from handbag 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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without seeing 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
cashier 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
could not pay 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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groceries 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
cashier 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
seeing 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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little girl 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
pick up the purse 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
leave 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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Mrs. White was mad 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
cashier 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
not stopped 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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little girl 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
Mrs. White yelled 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
him 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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left 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
outraged 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
thinking 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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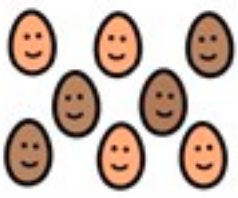
people 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
contact 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
theft 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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Narrative 2

Symbol	Rating	Comment/suggestions
weeding 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
garden 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
John 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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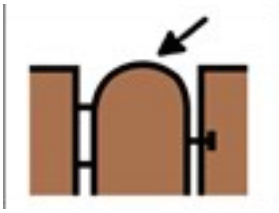
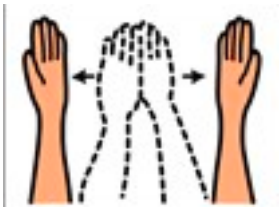
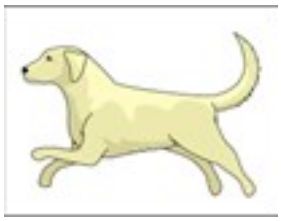
gate 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
open 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
dog ran 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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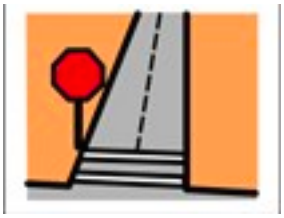
street 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
waited 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
John checked 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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animal shelter 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
worker 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
family 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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fallen in love 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
dog 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
family taken 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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home 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
not wanting to sadden 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
family 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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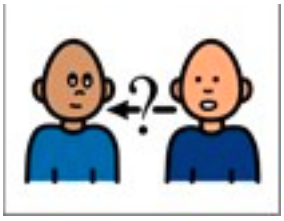
John 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
asked 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
worker 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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where 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
look 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	
new dog 	1 = The symbol doesn't represent the meaning of the word/s at all. 2 = The symbol represents the meaning of the word/s a little. 3 = The symbol represents the meaning of the word/s a lot.	

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Appendix S: Pilot study questionnaire for person with aphasia/significant other

INFORMATION ON PILOT STUDY

1. How understandable was the information letter for the person with aphasia? Please offer any suggestion

   ---

   ---

2. How understandable was the consent letter? Please offer any suggestions

   ---

   ---

3. How did you find the screening procedures? Were the instructions clear?

   ---

4. How did you find the length of time needed to finish the screening procedures?

   ---

5. How appropriate did you find the pictures used in the study?

   ---

6. How appropriate did you find the vocabulary used in the stories?

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7. How appropriate did you find the questions?

---

8. How easy/difficult did you find the questions?

---

9. How did you find the length of time needed for the experiment?

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Participant number	
Condition	
Order of narrative	

Appendix T: Comprehension items (1)

Lost Purse

1. The purse fell out of a

a. backpack

b. pocket

c. handbag

d. shopping bag

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Lost Purse

2. The woman's name was

a. Mrs. Wells

b. Mrs. James

c. Mrs. Wright

d. Mrs. White

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Lost Purse

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

a. cashier

b. house

c. petrol station

d. car

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Lost Purse

4. Mrs. White was in a

a. book store

b. grocery store

c. clothing store

d. pharmacy

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Lost Purse

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

a. neighbour

b. doctor

c. friend

d. bank

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Lost Purse

6. The purse was picked up by the

a. girl

b. cashier

c. boy

d. man

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Lost Purse

7. Mrs. White's money was

a. spent

b. hidden

c. returned

d. stolen

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Lost Purse

8. The cashier was

a. observant

b. grumpy

c. efficient

d. friendly

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Lost Purse

9. Mrs. White and the cashier

a. waited

b. argued

c. searched

d. left

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Lost Purse

10. Mrs. White learnt some people are

a. dishonest

b. generous

c. patient

d. forgetful

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Lost Purse

11. The cashier gave Mrs. White

a. information

b. change

c. advice

d. coupon

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Lost Purse

12. After talking to the cashier, Mrs. White felt

a. confused

b. relieved

c. angry

d. thankful

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Lost Purse

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

a. police officer

b. employee

c. customer

d. little girl

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Lost Purse

14. Mrs. White thought the cashier was

a. helpful

b. cheerful

c. lying

d. irresponsible

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Lost Purse

15. Mrs. White could not pay for her

a. clothes

b. groceries

c. books

d. coffee

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Appendix U: Comprehension items (2)

Participant number	
Condition	
Order of narrative	

Lost Dog

1. The man's name was

   a. Joe

   b. Don

   c. David

   d. John

Number of correct responses	

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Lost Dog

2. John was working in the

a. garage

b. house

c. park

d. garden

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Lost Dog

3. John learnt it was important to be

a. friendly

b. polite

c. hard-working

d. prompt

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Lost Dog

4. Regarding others, John was

a. considerate

b. outgoing

c. sarcastic

d. thoughtless

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Lost Dog

5. John learnt a consequence of being

a. trusting

b. deceitful

c. impatient

d. irresponsible

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Lost Dog

6. John looked for his dog in the

a. paper

b. park

c. animal shelter

d. town

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Lost Dog

7. Later, John will make an appointment with a

a. gardener

b. veterinarian

c. handyman

d. mechanic

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Lost Dog

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

a. happy

b. dead

c. returned

d. hungry

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Lost Dog

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

a. days

b. weeks

c. minutes

d. hours

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Lost Dog

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

a. dog

b. cat

c. fence

d. gate

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Lost Dog

11. The dog was adopted by a

a. little boy

b. old lady

c. family

d. worker

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Lost Dog

12. John's dog escaped by running through the

a. door

b. garage

c. hole

d. gate

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Lost Dog

13. To find a new dog, John asked the

a. family

b. worker

c. neighbor

d. veterinarian

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Lost Dog

14. The dog ran into the

a. street

b. field

c. ditch

d. park

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Lost Dog

15. When working in his garden, John was

a. watering

b. planting

c. weeding

d. pruning

Number of correct responses	

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Appendix V: Procedural checklist for screening procedures

Participant number	

PROTOCOL FOR SCREENING PROCEDURES

1. Greet person with aphasia and their significant other (if they are there).	"Hello …….. and ……	
2. Introduce yourself	"My name is Nicola and I am a speech therapist. I am busy with a masters degree in AAC."	
3. Thank them again for agreeing to participate.	"Thank you for agreeing to participate in this study".	
4. Explain purpose of the study.	"This study is investigating how to help people with aphasia following a stroke understand better."	
5. Explain nature of the study.	"Today we will start off with doing some screening procedures and then we will do the experiment."	
6. Explain duration of the study	"This meeting will take approximately 1 and a half hours. There is only one meeting"	
7. Explain information letter	"First we will go through this information letter to explain to you what the study is about." Go through information letter. "Do you have any questions?"	
8. 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."	

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9. Filling in biographical questionnaire	"I will now ask you some questions about yourself. If you are not able to answer these questions then I will ask your significant other to complete them"	
10. Administration of the WAB	"I will now to a short assessment with you 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 is not to help you with this."	
11. Administration of the Visual Perceptual Skills screening test	"Now I want you to look for the word "water" amongst these words. Please cross it out whenever you find it."	
12. Administration of the written choice strategy screening test	"Please complete these statements by pointing to your response. I will read each statement twice."	
13. Thank participant	"Thank you. We are now finished with the screening procedures"	
14. Offer a comfort break	"We can now take a short 15 minute break if you like. After that we will start with the experimental condition."	

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Participant number	

Appendix W: Treatment integrity checklist and script

INTEGRITY PROTOCOL

1. Switch on video camera.		
2. Inform the person with aphasia the we are starting with the experimental condition	"We will now be starting with the experimental condition"	
3. Give instructions to the person with aphasia.	"I will record you while I read you some stories and ask you some questions about the stories."	
4.	"I will read the story two times, and then we will need to answer some questions on the story."	
5.	"Listen carefully and take your time to answer."	
6. Place AI (PCS images) and high context images on table in front of the person with aphasia.	"Please take some time to look at these pictures. They will help you to understand the story"	
7. Allow person with aphasia to view these images for 1 minute uninterrupted.		
8. After 1 minute, leave the images in front of the person with aphasia while reading the first narrative.	"I will now read you the story"	
9. Read the narrative twice		
10. If it is the AI condition, simultaneously point to the PCS images while reading the narrative. If not the AI condition, do not point to the pictures.		
11. Read comprehension items.	"I will now ask you some questions about the story. Please show me your answer by pointing the word."	
12. Read each comprehension item twice	"I will read each question two times"	

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13. Remove comprehension items		
14. Remove all images		
15. Inform the person with aphasia you will be reading another story	"I will now read you another story."	
16. Place AI (PCS images) and high context images on table in front of the person with aphasia.	"Please take some time to look at these pictures. They will help you to understand the story"	
17. Allow person with aphasia to view these images for 1 minute uninterrupted.		
18. After 1 minute, leave the images in front of the person with aphasia while reading the first narrative.	"I will now read you the story"	
19. Read the narrative twice		
20. If it is the AI condition, simultaneously point to the PCS images while reading the narrative. If not the AI condition, do not point to the pictures.		
21. Read comprehension items.	"I will now ask you some questions about the story. Please show me your answer by pointing the word."	
22. Read each comprehension item twice	"I will read each question two times"	
23. Remove comprehension items		
24. Remove all images		
25. Thank person with aphasia and their significant other	"Thank you for your time".	
26. Switch off video camera		

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Appendix X: Questionnaire for research assistant on pilot study

Questionnaire for research assistant

1. Were the same procedures followed across the experimental condition amongst the different participants? If no, please elaborate.

   ---

2. What were some of the challenges?

   ---

3. What was done well during the experimental condition?

   ---

4. Please offer any suggests on how to improve the treatment integrity across the experimental conditions with the different participants.

Date

Name

Signature

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Appendix Y: Feedback brochure

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THE EFFECT OF AUGMENTED INPUT ON THE AUDITORY COMPREHENSION OF NARRATIVES FOR PERSONS WITH CHRONIC APHASIA

Nicola Stockley
Shakila Dada
Sarah Wallace

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Faculty of Humanities

Why we did the study ?

Difficulties in understanding language can impact greatly on persons' with aphasia quality of life. They may contribute towards feelings of frustration, increased dependence on family members and friends, and decreased independence.

What did we want to find out ?

Augmented input included the simultaneous speaking and pointing to visual aids to support the understanding of spoken language. The visual supports may include photographs, line drawings, gestures and signs. These supports are used by communication partners to assist the person with aphasia to understand what is being said to them better. In this study the augmented input used was photographs and line drawings that related to a story.
This study wanted to investigate the effect of augmented input on the auditory comprehension of stories for persons with chronic aphasia.

How did we do the study?

1. Speech Therapists in private practices who are providing therapy to persons with aphasia, were asked to help recruit participants
2. 12 persons with aphasia resulting from a stroke to the left cerebral hemisphere agreed to participate in the study. All participants were at least 6 months post stroke.
3. Each person was met individually in their homes. Each person with aphasia listened to 2 stories- 1 story where the line drawings were pointed to while reading the story, and 1 story where the line drawings were not pointed to
4. The persons with aphasia then had to answer 15 questions based on each story.

What did we find?

More people with aphasia (58%) answered more questions correctly when they listened to the story where the line drawings were pointed to. Those participants that had had exposure to line drawings before tended to benefit more from the pictures than those that had no prior exposure.

What does this mean?

This means that line drawings that are simultaneously pointed to while reading stories, may help some persons with aphasia understand the stories better. Increased exposure and practice with line drawings may also help persons with aphasia understand stories better.
More research is however needed to determine exactly who can benefit and how improved understanding can be fostered for all persons with aphasia.

Acknowledgements
A special word of appreciation to all the persons with aphasia and their family members that participated in the study. Further gratitude is expressed to all the Speech Therapists in the different private practices that assisted with recruitment of participants. This study was supported by grant-holder linked bursary from the National Research Foundation (# 99253). The views expressed in this paper are those of the authors and do not represent official positions or policies of the National Research Foundation.

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Appendix Z: Permission from hospital manager

PERMISSION LETTER FROM HOSPITAL MANAGER

I [redacted] as the hospital manager of

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

Signature..... Date.....3/2/17.....

Place.....LEIC.....

Researcher: Nicola Stockley

Signature..... Date.....03/02/2017.....

Place.....LEIC.....

[redacted]

Hospital Stamp

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Appendix AA: University of Pretoria ethics approval letter

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Research Ethics Committee

30 January 2017

Dear Prof Bornman

Project:	**The effect of augmented input on the auditory comprehension of narratives for individuals with chronic asphasia**
Researcher:	**N Stockley**
Supervisor:	**Prof S Dada**
Department:	**Centre for Augmentative and Alternative Communication**
Reference number:	**16386109 (GW20161114HS)**

Thank you for the response to the Committee's correspondence of 2 December 2016.

I have pleasure in informing you that the Research Ethics Committee formally **approved** the above study at an *ad hoc* meeting held on 30 January 2017. 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 your actual research depart significantly from the proposed research, it will be necessary to apply for a new research approval and ethical clearance.

The Committee requests you to convey this approval to the researcher.

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: tracey.andrew@up.ac.za

Research Ethics Committee Members: Prof MME Schoeman (Deputy Dean); Prof KL Harris; Dr L Blokland; Dr R Fasselt; Ms KT Govinder; Dr E Johnson; Dr C Panebianco; Dr C Puttergill; Dr D Reyburn; Prof GM Spies; Prof E Taljard; Ms B Tsebe; Dr E van der Klashorst; Mr V Sithole

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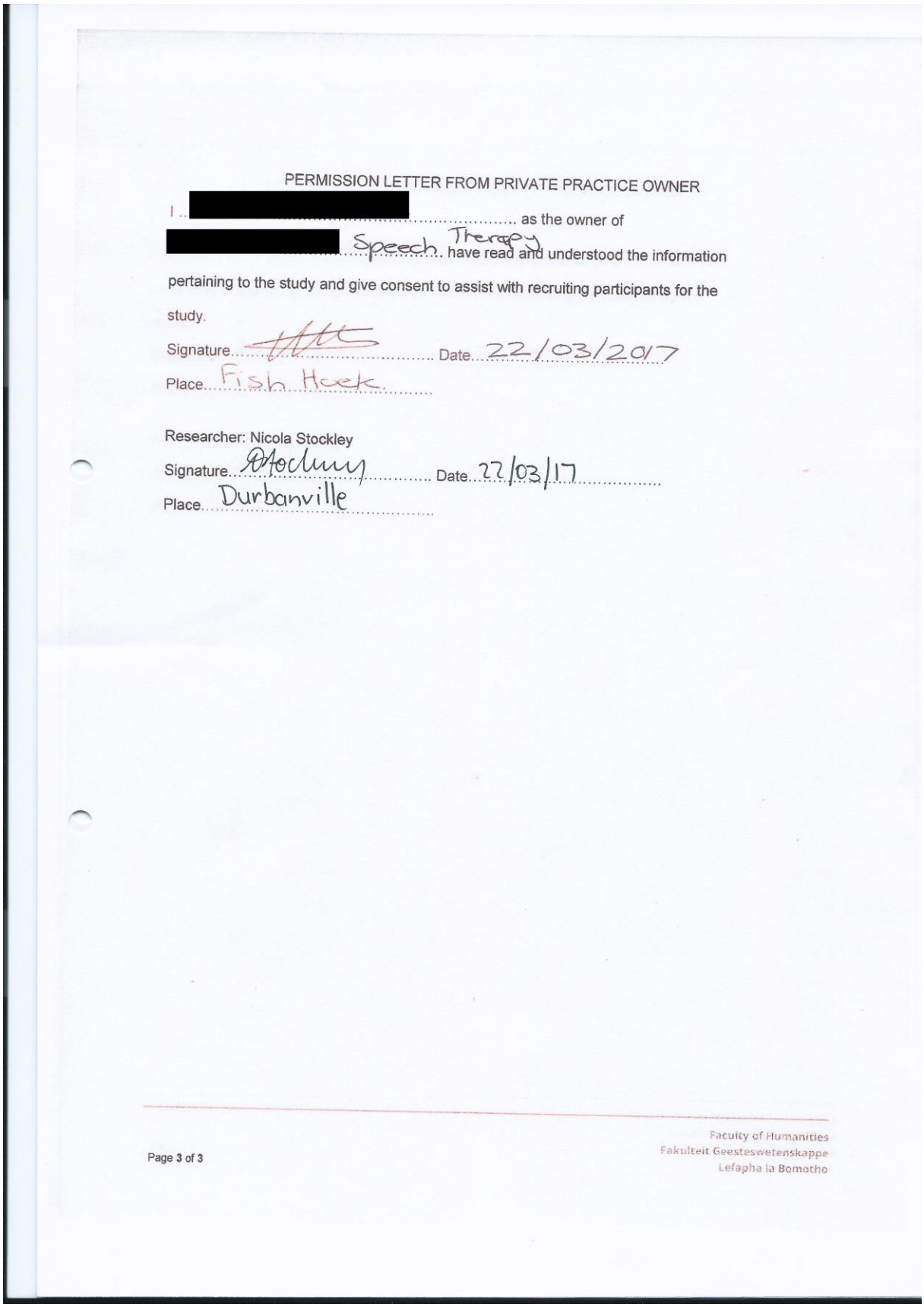
Appendix BB: Permission from private practices



PERMISSION LETTER FROM PRIVATE PRACTICE OWNER

I [redacted] as the owner of

[redacted] Speech Therapy have read and understood the information pertaining to the study and give consent to assist with recruiting participants for the study.

Signature [signature] Date 22/03/2017

Place Fish Hoek

Researcher: Nicola Stockley

Signature [signature] Date 22/03/17

Place Durbanville

Page 3 of 3

Faculty of Humanities
Fakulteit Geesteswetenskappe
Lefapha la Bomotho

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PERMISSION LETTER FROM PRIVATE PRACTICE OWNER

I [redacted] as the owner of

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

Signature Kwash Date 22.03.2017

Place Strand

Researcher: Nicola Stockley

Signature [signature] Date 22/03/17

Place Durbanville.

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PERMISSION LETTER FROM PRIVATE PRACTICE OWNER

I [redacted] as the owner of

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

Signature... Thom ..... Date... 15/12/16 .....

Place... Milnerton .....

Researcher: Nicola Stockley

Signature... [signature] ..... Date... 08/02/2017 .....

Place... LEIC (Cape Town)

Scanned by CamScanner

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PERMISSION LETTER FROM PRIVATE PRACTICE OWNER

I [redacted] as the owner of

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

Signature [signature] Date 22/3/17

Place SOMERSET WEST

Researcher: Nicola Stockley

Signature [signature] Date 22/03/17

Place Durbanville.

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PERMISSION LETTER FROM PRIVATE PRACTICE OWNER

I [redacted] ..... as the owner of

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

Signature..... Date.....16/01/2017.....

Place.....Cape Town.....

Researcher: Nicola Stockley

Signature..... Date.....08/02/2017.....

Place.....LEIC (Cape Town)

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Appendix CC: Permission from NGO

HELDERBERG
STROKE SUPPORT GROUP
BEROERTE ONDERSTEUNINGSGROEP
Tel: 021 852 8233
Cell: 079 612 8903

Reg. 016-622 NPO

PO Box 3973
Somerset West
7129

Miss N Stockley
University of Pretoria
Faculty of Humanities

1 February 2017

Dear Miss Stockley,

Re: Request for permission to recruit participants for Masters research from Helderberg Stroke Support Group NGO

With regard to your research project entitled "the effect of augmented input on the auditory comprehension of narratives for individuals with chronic aphasia".

At the committee meeting held on 26 January 2017 it was agreed that subject to you obtaining your ethics clearance number, The Helderberg Stroke Support Group will allow you to advertise for participants in our newsletter and visit their Community Rehabilitation groups to recruit participants.

We wish you every success with your study.

Yours sincerely

Marian Engelbrecht
Chairperson
Helderberg Stroke Support Group

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Appendix DD: 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:. **Nicola Stockley**

Student number: **16386109**

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…. (eg essay, report, project, assignment, dissertation, thesis, etc) 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: 

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Appendix EE: Declaration by language editor

Sarah Fern Middleton
Editing & proofreading

TO WHOM IT MAY CONCERN

I hereby confirm that I conducted the language editing of the Master's dissertation/mini-dissertation of Nicola Stockley. The document with my edits was sent to the student on 1 June 2017.

Sarah Fern Middleton
Tel: 0726204018
email: sarah.fern.middleton@gmail.com

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