COMMUNICATION PARTNER ATTITUDES, SOCIAL AND COGNITIVE CHALLENGE, AND SPOKEN LANGUAGE IN APHASIA

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ABSTRACT

Tyson G. Harmon: Communication Partner Attitudes, Social and Cognitive Challenge, and Spoken Language in Aphasia
(Under the direction of Adam Jacks and Katarina L. Haley)

The purpose of these studies was to investigate how partner attitudes, attention, and emotion affect communication in aphasia. The first study investigated the attitudes of potential communication partners regarding speech output, speaker attributes and their own feelings after hearing unaltered and digitally modified samples from PWA as well as samples from speakers with no aphasia. Listeners reported less favorable attitudes about PWA than speakers with no aphasia. In addition, samples that were modified to sound more fluent caused listeners to improve their attitudes.

The second study investigated the impact of cognitive and social demands on psychological stress and spoken language for PWA. Twenty-one PWA (10 moderate, 11 mild) and 12 controls retold short stories to a supportive partner, nonsupportive partner, and with a dual task (i.e., discriminating between high and low tones). Spoken language was measured in terms of content accuracy and delivery speed. Dual task communication was more detrimental to the spoken language of PWA than controls but different speed-accuracy trade-off patterns were noted for the mild and moderate aphasia groups. The effects of communicating with a nonsupportive partner varied among individual participants; there were, however, correlations between ratings of stress and story retell performance across all conditions.

After retelling stories in the three experimental conditions, participants were interviewed. Interviews were transcribed and analyzed qualitatively to explore participants' subjective reactions when communicating with nonsupportive partners and under divided attention. PWA were found to be biased toward negative stimuli and have a heightened emotional response in these situations. Social and cognitive demands also resulted in less favorable self-perceptions of their performance. To deal with these demands, participants with mild aphasia commented on using a variety of intentional strategies.

Together, these studies show that the speech of PWA leads to unfavorable attitudes, which—when manifest through nonsupportive partner behaviors—results in negative emotional reactions from PWA and distorts their perception of the communication experience. Communicating with a dual task also results in negative emotions and perceptions for PWA. In addition, their spoken language significantly deteriorates. People with mild aphasia seem more capable of dealing with increased situational demands by employing strategies.

In memory of Dr. Ron Channell: advisor, mentor, and friend.

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LIST OF ABBREVIATIONS

AQ	Aphasia Quotient
AS	Aphasic Speech
BNT	Boston Naming Test
CCRSA	Communication Confidence Rating Scale
DT	Dual Task
GDS	Geriatric Depression Scale
LG	Listener Group
NH	Neurologically Healthy
NP	Nonsupportive Communication Partner
PRCA-24	Personal Report of Communication Apprehension
PWA	People with Aphasia
QVSFS	Questionnaire for Verifying Stroke-Free Status
RT	Response Time
SF	Simulated Fluency
SP	Supportive Communication Partner
TALSA	Temple Assessment of Language processing and Short-term memory in Aphasia
TONI-IV	Test of Nonverbal Intelligence, Fourth Edition
TPO	Time Post-Onset
UNC-CH	University of North Carolina at Chapel Hill
WAB	Western Aphasia Battery Revised

CHAPTER 1: INTRODUCTION

People with aphasia (PWA) struggle to transfer the gains they make in speech language therapy to everyday communication situations and frequently withdraw from social settings (Carragher, Conroy, Sage, & Wilkinson, 2012; Le Dorze, Salois-Bellerose, Alepins, Croteau, & Hallé, 2014; Nadeau, 2014; Parr, 2007). Although mounting evidence has revealed the benefits of speech-language treatment for people with aphasia in general (Brady, Kelly, Godwin, Enderby, & Campbell, 2016), these improvements are most often shown on specific tasks in controlled therapy environments and do not necessarily reflect better daily verbal communication, which is widely accepted as the ultimate goal of therapy (Nadeau, 2014). Contextual generalization (i.e., the transfer of skills and knowledge to daily conversational life) has rarely been investigated and, when assessed, has proven difficult to achieve (see e.g., Carragher et al., 2012).

One challenge to contextual generalization and social participation in aphasia is that attentional and emotional demands are greater in everyday communication situations than in the therapy room. Everyday communication and participation is influenced, for example, by communication partner support and environmental noise (Baylor, Burns, Eadie, Britton, & Yorkston, 2011; Garcia, Barrette, & Laroche, 2000; Le Dorze et al., 2014). Thus, the impact of communication partners and the role of attentional and emotional processing in speech and language function are of particular interest when considering improved everyday communication.

Communication Partners

Everyday communication is interactive. It involves at least one person who transmits a message and another who receives it. Both parties influence each other (Bernieri & Rosenthal, 1991; Burgoon, Le Poire, & Rosenthal, 1995). This knowledge has been the impetus for much of the work on communication partner training, which seeks to improve the communication of PWA by teaching their partner to be supportive (see Simmons-Mackie, Raymer, Armstrong, Holland, & Cherney, 2010; Simmons-Mackie, Raymer, & Cherney, 2016).

Important aspects of communication partner support are the partner's attitude toward the speaker and the nonverbal behaviors they demonstrate. With this in mind, communication partner training programs may give special attention to how partners view and react to PWA (e.g., Kagan, Black, Duchan, Simmons-Mackie, & Square, 2001; Lock et al., 2001). For example, partners might be trained to be patient and friendly in order to help PWA feel comfortable.

While training communication partners to be supportive is important, it is most practical for close family members and friends. To improve generalization and social participation, PWA need opportunities to communicate in social settings outside their home. In such settings, they will inevitably confront partners who are not trained in supportive communication (Dalemans, de Witte, Wade, & van den Heuvel, 2010; Davidson, Howe, Worrall, Hickson, & Togher, 2008; Parr, 2007). The attitudes of these partners toward PWA and the impact of their behaviors on the emotional response of PWA are important to consider.

Chapter 2 in the present work addressed potential communication partners' attitudes and perceptions in response to aphasic speech. We wanted to know how the speech production of PWA influenced the thoughts, feelings, and attitudes of listeners. We compared the perceptions of listeners who heard narrative samples from participants with no aphasia and PWA. To understand how speech fluency affects perceptions, an additional group of simulated fluent samples was also included. These samples were modified by deleting all disfluent behaviors. Because previous studies suggest that a lack of knowledge and education about aphasia contributes to nonsupportive attitudes and behaviors (Dalemans et al., 2010; Le Dorze et al., 2014), we divided potential communication partners into two groups based on their educational experience. We found that potential communication partners perceived PWA less favorably but their perceptions were more favorable when aphasic samples were made fluent. Even those with some education about aphasia perceived PWA significantly less favorably and experienced feelings of impatience and discomfort.

The finding that potential communication partners experience less favorable perceptions of PWA based on their speech output formed the foundation for the studies reported in chapters 3 and 4. Partners' feelings of discomfort and impatience are likely to be reflected in the behaviors they demonstrate during a communicative exchange. But do these behaviors affect PWA? One aim of chapters 3 and 4 was to understand how nonsupportive partner behaviors influence how PWA feel. In chapter 3, we measured psychological stress quantitatively using a self-report rating scale. In chapter 4, we explored comments that participants made during a semi-structured interview about their emotional reaction to a nonsupportive partner. In each study emotional reactions were compared between participants with mild, moderate, and no aphasia. The findings showed that talking to a nonsupportive partner induces more stress and a stronger overall emotional response than talking to a supportive communication partner. Additional aims from chapters 3 and 4 were to understand the effects of attention and emotion on spoken language in aphasia.

Attention, Emotion, and Language

Among other higher order cognitive functions, attention and emotion influence communication and may be subserved by neural networks that dynamically interconnect with language networks (Cahana-Amitay & Albert, 2015b). Neuroimaging studies have demonstrated that attention networks are involved in novel verb generation (Pertersen & Fiez, 1993), self-monitoring, and self-correction during verb generation (Myachykov & Posner, 2005), and sentence processing (Rogalsky & Hickok, 2009). Language tasks have also been shown to increase physiological stress response, which suggests the involvement of the hypothalamo-pituitary-adrenal axis (Dickerson & Kemeny, 2004). In addition, various studies have shown that anxiety can lead to a breakdown in communication (Buchanan, Laures-Gore, & Duff, 2014; Cahana-Amitay et al., 2015; Christenfeld & Creager, 1996). These and similar findings led to the development of the *theory of neural multifunctionality*, which posits that the dynamic interaction and integration of neural networks responsible for linguistic and nonlinguistic functions (e.g., attention and emotion) determines communicative performance and impacts language rehabilitation (Cahana-Amitay & Albert, 2015a, 2015b).

Attention

Multiple studies have shown that PWA are vulnerable to deficits in attention, which impact their nonlinguistic and linguistic processing (e.g., Erickson, Goldinger, & LaPointe, 1996; LaPointe & Erickson, 1991; Murray, Holland, & Beeson, 1997; Tseng, McNeil, & Milenkovic, 1993). Further, Murray (2012) found that most PWA score in the impaired range on standardized measures of attention with more complex attention skills having stronger relationships with communication and language. Divided attention performance is of particular interest because of its relation to complex everyday communication situations. With this in mind, Hinckley and Carr (2005) used a divided attention task to simulate real-world distractions during a functional treatment program.

To our knowledge, only one study has previously investigated the effects of divided attention on running speech in aphasia (Murray, Holland, & Beeson, 1998). Unlike that study, we used a narrative discourse task and included measures of speech fluency and a moderate aphasia group. Our aim was to understand how divided attention differentially affects content accuracy and delivery speed among people with mild, moderate, and no aphasia. Our findings revealed group-specific speed accuracy trade-offs. Chapter 4 expanded on these findings to explore the subjective experience of PWA when communicating under divided attention.

Emotion

Along with attention, emotion plays an important role in language function and recovery from aphasia. Symptoms of depression and anxiety are common after stroke (Hackett, Yapa, Parag, & Anderson, 2005) and may be even more prevalent for those with aphasia (Shehata, El Mistikawi, Risha, & Hassan, 2015). Using language may be one source of stress for PWA (Cahana-Amitay et al., 2011; Laures-Gore, Heim, & Hsu, 2007), but the social situations in which language is used might also contribute to these feelings. Qualitative studies have found that communication partner reactions and noisy environments can cause barriers to communication and participation for PWA (Baylor et al., 2011; Garcia et al., 2000).

Chapter 3 addressed how perceived stress (induced by talking to a nonsupportive partner) affects communication for people with mild, moderate, and no aphasia. In chapter 4, we qualitatively explored how stressful communication situations (talking to a nonsupportive partner and with a dual task) affected perceptions that PWA had about their performance. Strategies used to meet the demands of these situations were also explored. While the effects of stress on communication were found to vary, its influence might be particularly detrimental over time because of how it affects the way PWA perceive their communication experiences.

Taken together, the three studies presented herein represent first steps toward understanding the intricate interactions between partner attitudes, attention, emotion, and spoken language that shape everyday communication for PWA. The findings offer insights that could better inform clinical practice. They also point to a need for further research about how partner attitudes, attention, and emotion interact with communication and recovery in aphasia.

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CHAPTER 2: LISTENER PERCEPTIONS OF SIMULATED FLUENT SPEECH IN NONFLUENT APHASIA[1]

Introduction

Listener perceptions play an important role in the communicative interactions of people with aphasia (PWA). Listeners often perceive the speech output and personal attributes of PWA less favorably than their peers (Allard & Williams, 2008; Croteau & Le Dorze, 2001; Zraick & Boone, 1991). Additionally, listeners may perceive themselves as having negative feelings in response to PWA. Communication partner training has shown that listeners can change their perceptions of PWA and contribute to improved communicative interaction (Kagan, Black, Duchan, Simmons-Mackie, & Square, 2001). While directly training the listener is an important way to change societal impressions, listeners' perceptions may also change as PWA modify their speech and language behaviors. Behavioral modification might similarly lead to increased opportunities for successful communicative interactions. The relationship between the speech behavior of PWA and societal impressions, however, has rarely been investigated. The present study examined the impact of digitally altered fluency on listener perceptions of people with nonfluent aphasia.

Perceptions of PWA

PWA are concerned about the way they are perceived by communication partners. In semi-structured interviews, PWA have identified negative perceptions of communication partners as causing them to feel misunderstood and unsupported. These perceptions create

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barriers to their communicative participation (Le Dorze, Salois-Bellerose, Alepins, Croteau, & Hallé, 2014; Le Dorze & Brassard, 1995). Parr (2001) reported on qualitative interview data from 50 PWA and found that disabling attitudes such as ignorance, prejudice, and pity were among the principal social barriers interviewees described. For example, one PWA commented about being ignored in public places, while another remarked on being deemed an "imbecile" (Parr, 2001, p. 276). Others have observed that being viewed as "stupid" is, in fact, a common fear for many PWA (Kagan, 1998). Such negative perceptions can increase the burden of communication and augment anxiety or apprehension about social interaction. PWA have specifically reported holding back, withdrawing, and even avoiding social situations because they were afraid of being perceived negatively (Le Dorze et al., 2014).

Unfortunately, in accordance with their fears, negative perceptions of PWA seem to be a reality. Previous research clearly suggests that loved ones and the general public perceive PWA, particularly those with nonfluent aphasia, less favorably than their peers. These negative assumptions are not restricted to the speech output but also include negative impressions about the character, personality, and attributes of PWA. Zraick and Boone (1991) compared perceptions among spouses of people with nonfluent aphasia, fluent aphasia, and a control group. Seventy statements were combined into six factors (i.e., maturity, independence, desirability, compliance, egocentricity, and sociability). Spouses of individuals with nonfluent aphasia perceived their spouse more negatively on all factors when compared with spouses of people without aphasia. In addition, people with nonfluent aphasia were perceived as less independent, compliant, and sociable than those with fluent aphasia. Similarly, Croteau and Le Dorze (2001) used an adjective checklist to show that PWA were viewed by their spouse as being more dependent and less likable than people without aphasia. They also found that spouses perceived their partner with aphasia significantly worse in achievement, endurance, and organization. The authors argued that negative spousal perceptions might exacerbate the impairments of PWA. In other words, their abilities may decrease due to diminished spousal expectations associated with negative perceptions.

The personality and attributes of PWA are also perceived less favorably by unfamiliar communication partners. Several studies have documented that unfamiliar communication partners may not be aware of the competence and intelligence of PWA. (Kagan, 1998; Le Dorze et al., 2014; Simmons-Mackie & Damico, 2007; Simmons-Mackie & Elman, 2011). However, the perceptions of unfamiliar communication partners have mostly been reported from the perspective of PWA. One exception is a study conducted by Allard and Williams (2008) in which 445 listeners heard an actor's depiction of Wernicke's aphasia, articulation disorder, stuttering, voice disorder, and no disorder. They found that listeners perceived the Wernicke's aphasia condition as significantly less decisive and reliable, and more anxious than the other four conditions. Although little research is available regarding listeners' perceptions of PWA, less favorable speaker attributes appear to be ascribed to PWA by both familiar and unfamiliar communication partners.

In addition to perceiving the attributes of PWA less favorably than peers without aphasia, listeners also feel uncomfortable interacting with PWA. Lasker and Beukelman (1999) compared listeners' perceptions of storytelling by a PWA under three conditions: unaided and using two different modes of augmentative and alternative communication (AAC; i.e., a communication notebook and digitized speech). Similar-aged peer listeners viewed audiovisual recordings of each condition. Mean Likert ratings showed that listeners felt most uncomfortable listening to unaided aphasic speech. The listeners reported that their discomfort was, in part, due to lack of understanding and difficulty fulfilling their role as communication partner.

Listener discomfort may cause people to avoid conversations with PWA. This is evident from both the perspective of PWA and their communication partners. PWA have reported that speaking partners seem to avoid attempting or pursuing conversation with them due to discomfort (Le Dorze et al., 2014). Family members and friends have reported regularly performing communicative tasks such as reading, writing, and answering questions for the PWA (Le Dorze & Brassard, 1995). Discomfort felt by communication partners may limit social interaction for PWA.

Communication partner perceptions regarding speech, speaker attributes, and their own feelings during interaction have important implications for autonomy and identity of PWA. Shadden and Agan (2004) described that fostering values of respect, acceptance, validation, and encouragement were key elements of a stroke support group that aimed to nurture identity. In a qualitative analysis of a group therapy session involving 10 people with aphasia, Simmons-Mackie and Elman (2011) confirmed that respect and an assumption of competence by communication partners marked important aspects of identity renegotiation during group therapy. From these two studies, it appears that fostering positive perceptions of PWA is critical in successfully renegotiating identity.

Perceptions have the potential to change communicative interactions between PWA and their partners. Negative and incorrect perceptions about PWA can promote social isolation and limit opportunity for communicative interaction. Simmons-Mackie and Damico (2007), for example, have suggested that communicative interactions between PWA and their conversation partners can be negatively impacted by inequality and marginalization, which occur when PWA are looked down on. The authors proposed that the solution to these issues includes partners perceiving PWA as competent and able to contribute to an interaction. Because negative perceptions interfere with communication, they have been targeted in communication partner training (Kagan et al., 2001; Kagan, 1998).

Perceptions of communication partners can change with intervention. In communication partner training, partners are taught to successfully converse with PWA (Simmons-Mackie, Raymer, Armstrong, Holland, & Cherney, 2010; Turner & Whitworth, 2006). Training usually includes strategies that partners can integrate into their interactions to improve the communicative exchange and encourage participation (Turner & Whitworth, 2006). One area of emphasis in Supported Conversation for Adults with Aphasia (SCA; Kagan et al., 2001) is acknowledging competence, which includes an assumption of competence as well as attitudes of encouragement, support, and respect. Kagan et al. (2001) found that 17 out of 20 trained volunteers improved in their scores of acknowledging competence during a conversation with PWA. Thus, direct intervention can affect partner communication, which may, in turn, improve their perceptions and overall interactions with PWA.

Speech fluency as a behavior of interest

Another way to improve listener perceptions is to change the speech qualities that trigger negative perceptions in the first place. In the present study, we consider the social outcome of listener perceptions as a function of speech behavior. The behavior selected for manipulation in this study was speech fluency. Based on evidence from the stuttering literature, we speculated that fluency—though rarely targeted directly in aphasia treatment—might have important social impact by moderating listener perceptions about the speaker's competence and personality. We define disfluency herein as any behavior that impedes the forward flow of speech (Van Riper, 1982). Both language and motor speech impairments common in nonfluent aphasia (i.e., anomia, agrammatism, or apraxia of speech) are likely to contribute to disfluent speech production (McNeil & Copland, 2011). For example, poor word retrieval may result in pauses and hesitations, agrammatism might impact rhythm, and difficulties programming motor speech tasks may trigger revisions and repetitions.

Increased speech fluency through simulation has led to improved listener perceptions of people who stutter (Evans, Healey, Kawai, & Rowland, 2008; Panico, Healey, Brouwer, & Susca, 2005; Susca & Healey, 2001). These improvements have been shown across listener perceptions regarding speech output, speaker attributes, and listener feelings in response to stuttered speech (Evans et al., 2008; Lay & Burron, 1968; Panico et al., 2005; Susca & Healey, 2001, 2002; Von Tiling, 2011). Conversely, listeners have made more negative comments about the character traits (i.e., pleasantness, friendliness, confidence, and intelligence) of more disfluent speakers (Susca & Healey, 2002; Von Tiling, 2011). Listeners also perceive themselves as less comfortable, expending more effort, and becoming more impatient while listening to increasingly disfluent speech (Panico et al., 2005; Susca & Healey, 2001, 2002). The impact that speech fluency has on listener perceptions of people who stutter might transfer to other populations such as PWA.

To our knowledge, no study has yet been conducted on how simulated speech fluency of PWA impacts listener perceptions. The purpose of the present study was to (a) confirm the previous literature regarding less favorable listener perceptions of PWA and (b) determine if increasing speech fluency from PWA through digital manipulation affects listener perceptions. Based on the stuttering literature, we postulated that increased fluency would improve listener perceptions of PWA. As a secondary goal we sought to determine whether graduate students who had taken a course about neurogenic communication disorders and undergraduate students differed in their perceptions of PWA. Because communication partner training has been shown to improve behaviors of acknowledging competence (Kagan et al., 2001), we hypothesized that graduate student listeners would perceive PWA more positively than undergraduate listeners.

Method

Participants

Speakers. Audio samples were obtained from nine speakers using the *AphasiaBank* database (http://talkbank.org/AphasiaBank/). These were monologue language samples from the discourse production portion of the *AphasiaBank* protocol for story narrative (AphasiaBank, 2007). Six aphasic speech samples were obtained using the following criteria: Western Aphasia Battery (WAB; Kertesz, 2006) classification of Broca's aphasia, WAB aphasia quotient of greater than 40, and Boston Naming Test short form (Kaplan, Goodglass, & Weintraub, 1983) score of greater than or equal to five (see Table 2.1). The remaining three *AphasiaBank* samples were from neurologically healthy speakers.

Table 2.1. Demographics and Clinical Test Scores from Nine Speaker Participants

Speaker	Sex	Age	BNT	WAB Fluency	WAB Aphasia Quotient	WAB Classification
P01	F	69.9	6	2	63.9	Broca
P02	M	66.2	8	4	77.6	Broca
P03	F	54.7	8	4	59.4	Broca
P04	M	41.9	9	4	70.1	Broca
P05	F	53.9	5	4	40.9	Broca
P06	M	54.9	11	4	72.2	Broca
P07	F	75.6	NA	NA	NA	Control
P08	M	41.0	NA	NA	NA	Control
P09	F	61.3	NA	NA	NA	Control

Note. BNT = Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1983); WAB = Western Aphasia Battery Revised (Kertesz, 2006).

Listeners. Thirty-six adults participated as listeners. Eighteen were undergraduate students (16 females) from the University of North Carolina at Chapel Hill (UNC-CH). They had declared a variety of majors and were between the ages of 18 and 22 (*M* = 19.5). Eighteen were graduate level speech-language pathology (SLP) students (15 females) between the ages of 22 and 40 (*M* = 26.5). Fourteen graduate students and five undergraduate students reported 10 or more hours listening to or working with adults with speech or language problems. In addition, all graduate students had taken at least one semester-long course about adult neurogenic communication disorders.

Listeners were asked to rate nine audio samples from three sample conditions. Ratings were based on listeners' perceptions of the speech, thoughts about the speaker, and feelings associated with listening to the sample.

Procedures

Audio samples. After selection, each of the six aphasic speech samples was modified to create a simulated fluent sample. Information about the audio samples used in the study is summarized in Table 2.2. The first author followed a procedure used in previous studies (Lay & Burron, 1968; Susca & Healey, 2001) to create simulated fluent samples in Audacity 2.0.5 (Audacity Team, 2013) by deleting pauses greater than 0.4 seconds, fillers, filled pauses, repetitions, and revisions through waveform editing. Repetitions were defined as speech sounds, words, or phrases that were produced immediately before or after the same sound, word, or phrase. Self-corrections and revisions were defined as multiple attempts at a word or phrase that did not fall under the category of a repetition. Pauses (i.e., time lapsed without speech sound production), fillers (e.g., um), and filled pauses (i.e., time lapsed with intermittent fillers) were also deleted. The resulting samples were subsequently judged for naturalness by the first three authors. They rated naturalness independently on a five-point scale (1 = unmodified, 5 = heavily modified). Consensus ratings, based on initial impressions, are listed in Table 2.2. Two of the six samples were rated as unmodified, three were rated as equivocally modified, and one was rated as slightly modified. None were rated as moderately or heavily modified.

Table 2.2. Audio Sample Information

Speaker		Sample Group	Naturalness Rating	Sample Length	Speech Rate
P01	Aphasic Speech	B	1	2:58	1.07
	Simulated Fluency	A	2	0:52	2.30
P02	Aphasic Speech	B	1	10:12	0.60
	Simulated Fluency	A	1	2:40	1.08
P03	Aphasic Speech	B	1	3:36	1.33
	Simulated Fluency	A	2	1:32	2.28
P04	Aphasic Speech	A	1	6:42	0.47
	Simulated Fluency	B	3	1:08	2.00
P05	Aphasic Speech	A	1	4:38	0.75
	Simulated Fluency	B	1	1:33	1.71
P06	Aphasic Speech	A	1	9:51	1.05
	Simulated Fluency	B	2	3:00	2.86
P07	Neurologically Healthy	A, B	NA	0:42	3.49
P08	Neurologically Healthy	A, B	NA	2:25	4.41
P09	Neurologically Healthy	A, B	NA	3:22	3.05

Note. Naturalness rating represents the consensus rating reached by three judges. Naturalness ratings were provided on the following scale: 1 = unmodified; 2 = equivocally/questionably modified; 3 = slightly modified; 4 = moderately modified; 5 = heavily modified. Sample length is represented in minutes and seconds (MM:SS). Speech rate represents syllables per second.

Syllable boundaries were coded automatically using a customized syllable identification routine implemented in Praat to obtain the number of syllables produced in each sample (Boersma & Weenink, 2014; de Jong & Wempe, 2009; Haley, Jacks, Riesthal, Abou-khalil, & Roth, 2015). Automated syllable coding was then checked manually by research assistants before speech rate (i.e., syllables per second) was calculated for each sample. We used speech rate as a proxy measure for speech fluency but did not count specific disfluent behaviors or percentage of disfluencies, as the reliability of coding for these is often limited (e.g. Curlee, 1981). The speech rate for the simulated fluent samples was, on average, 2.49 syllables per second greater than the speech rate for the aphasic speech samples. The mean duration of the aphasic speech, simulated fluent, and neurologically healthy samples were 6 min 19 s (*SD* = 3 min 8 s), 1 min 47 s (*SD* = 51 s), and 2 min 9 s (*SD* = 1 min 21 s) respectively. Figure 2.1 shows a spectrogram of a paired portion of the aphasic speech and simulated fluent samples for P01.

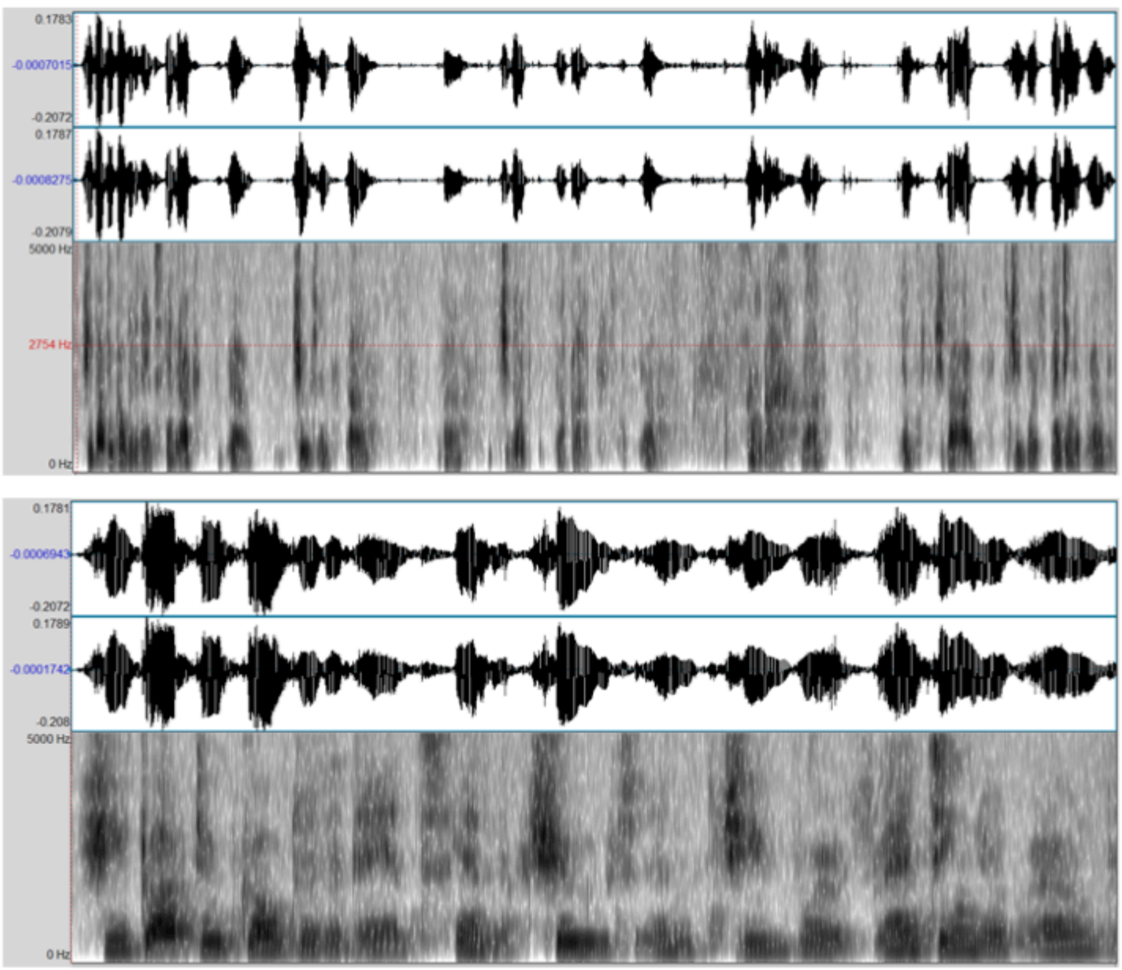

Figure 2.1. Visual depiction of matched portions of aphasic speech and simulated fluent samples in Praat (Boersma & Weenink, 2014) for participant P01. The top spectrogram and waveform shows a portion of the aphasic speech sample (30.37s). The bottom spectrogram and waveform show the matched portion with fluencies deleted (6.47s)—the simulated fluent sample.

For listening purposes, the speech samples were partitioned into two groups so that no listener could hear the same speaker with aphasia under both the unmodified and simulated fluency conditions. If a speaker's unmodified speech sample appeared in group A, his/her simulated fluent speech sample had to appear in group B, and vice versa. All listeners heard three samples of unmodified aphasic speech, three samples of simulated fluent speech, and three samples from neurologically healthy speakers (see Table 2.2, "Listener Group" column). To keep the listeners blind to the experimental manipulation, they were not informed about the editing or modification of the aphasic speech samples.

Questionnaire. The questionnaire consisted of nine seven-point Likert statements (ranging from strongly disagree to strongly agree). The nine statements were formulated based on adaptation of similar questionnaires used in the stuttering literature (Evans et al., 2008; Panico et al., 2005; Susca & Healey, 2001). The statements were divided into three categories (i.e., speech output, speaker attributes, listener feelings) to measure various aspects of listener perception. As previously explained, listener perceptions are not confined to impressions about speech behavior per se, but also encompass thoughts about the personality and characteristics of the speaker and feelings that listeners experience in response to speech (Ostrom, 1969). Separation of the statements into the three categories followed a procedure used by Evans et al. (2008) who divided individual Likert statements into behavioral (pertaining to the *speech*), cognitive (pertaining to *thoughts* about the speaker), and affective (pertaining to *feelings*) responses. The nine declarations included two concerning speech output (Sp), four about speaker attributes (SA), and three regarding listener feelings (LF). The nine statements were:

1. I would feel comfortable having a conversation with this person. (LF)

2. This person's speech made me feel impatient. (LF)
3. I felt like listening to this person speak took a lot of effort. (LF)
4. This person told the story easily. (Sp)
5. I think this person is intelligent. (SA)
6. I think this person lacks confidence. (SA)
7. I think this person is a competent speaker. (SA)
8. This person's speech was hard to understand. (Sp)
9. I think this person would have a hard time making friends. (SA)

Three open-ended questions were also included in the questionnaire to probe qualitative aspects of the listeners' perceptions. Responses from open-ended questions are not reported in this study.

Data collection. Listening sessions occurred individually (12 listeners) or in groups ranging in size from two to six people (24 listeners). All sessions took place on the UNC-CH campus in a quiet room behind closed doors. Sessions were randomly assigned to either sample group A or B. The order of sample presentation was randomized for each of these groups. Although all listeners during group sessions listened to the same sample group, an equal number of graduate and undergraduate student listeners heard the same samples in the same order. The audio samples were presented in a sound field over PC speakers. To ensure a comfortable intensity level, listeners were given control of adjusting the speaker volume throughout the session. In the group listening sessions, one listener was assigned volume control for the group.

During the session, participants were each sent an online survey link to their personal email account. They each responded to the survey items on a personal laptop or laboratory computer. They were instructed to respond independently and refrain from talking throughout the session. The first author was present at each listening session to provide instructions and ensure that no discussion took place between listeners.

Listeners responded to nine Likert statements, presented in randomized order, immediately following the presentation of each sample. In other words, listeners heard a sample, rated their perceptions of that sample, then repeated the process for a different speaker. Each listener or group heard each of the nine samples once. When a listening session occurred in a group, all listened to the same sample simultaneously then provided individual responses to Likert statements. Upon completing the listening session, the listeners were asked to keep details of the experiment confidential in order to avoid biasing the responses of future participants. Prior to data analysis, scores from all negatively worded Likert statements were inverted so higher scores would represent more positive perceptions across all questions.

Design and Statistical Analysis

The design of the present study can be conceived of as a complex factorial design with both crossed and nested factors. As shown in Table 2.3, the design included within group factors for Aphasia (i.e., whether the sample was from an Aphasic or Non-aphasic speaker), Fluency (i.e., whether samples from speakers with aphasia were Modified or Unmodified), and Speaker (i.e., individual speakers that produced each sample). The Fluency factor was nested within the Aphasia factor. Thus, unmodified aphasic speech samples were coded as Aphasic-Unmodified, simulated fluent samples were coded as Aphasic-Modified, and samples from neurologically healthy speakers were coded as Non-aphasic. Individual speakers were nested within each of these sample conditions. As noted above, the modified and unmodified speech samples were divided into two Sample Groups (A, B) containing three samples from each condition. If speaker P01's unmodified speech sample appeared in Sample Group A, his or her modified speech sample (P01*) would appear in Sample Group B, and vice versa (see Table 2.3). This prevented any listener from hearing both the unmodified and modified speech samples of any speaker. As also shown in Table 2.3, the within group factors were crossed with a between group factor for Listener Group (Undergraduate, Graduate).

Table 2.3. Complex Factorial Design for Statistical Analysis.

			Within Group Factors		
			Aphasia Factor		
			Aphasic		Non-aphasic
			Fluency Factor		
			Fluency Unmodified	Fluency Modified	
			Speakers	Speakers	Speakers
Between Group Factor	Undergraduate Student Listeners	Group A	P04, P05, P06	P01*, P02*, P03*	P07, P08, P09
		Group B	P01, P02, P03	P04*, P05*, P06*	P07, P08, P09
	Graduate Student Listeners	Group A	P04, P05, P06	P01*, P02*, P03*	P07, P08, P09
		Group B	P01, P02, P03	P04*, P05*, P06*	P07, P08, P09

Note. * indicates simulated fluent speech.

Listener ratings were analyzed using a mixed effects ANOVA model. Dependent variables included Likert scores for each individual question and an overall composite (average) of the nine questions. A mixed effects ANOVA model was especially appropriate in the present application because it allowed for both estimation of the same error terms as a conventional repeated measures ANOVA and estimation of additional sources of heterogeneity associated with speakers. Mixed effects models also allow for estimation of fixed effects such as those associated with Aphasia, Fluency, and Listener Group. It should be noted that, due to nesting, we can only uniquely estimate the nested effect of the Fluency factor and not a Fluency by Aphasia interaction.

In the present design, we distinguish between primary effects of interest and secondary effects associated with individual speaker differences. Secondary effects included any estimable terms, including interactions, involving the Speaker factor. Because individual differences among speakers are naturally expected and because the purpose of the present study was not to determine the effects of different speakers on listener perceptions but rather the effects of aphasia and simulated fluency, we included these terms in all models, but treated them as statistical nuisance parameters. That is, they were treated as effects that must be included in statistical models in order to obtain unbiased estimates of the primary effects of interest but are not of inherent interest themselves. Although space and parsimony preclude reporting the secondary effects in detail, we note that numerous speaker effects were observed.

Primary effects of interest in this study were ones involving Aphasia, Fluency, Listener Group, and interactions of Aphasia by Listener Group and Fluency by Listener Group. This model was reduced to find the most parsimonious model for each of the ten dependent variables, but for completeness, we report results based on the full model (see Table 2.4).

Following mixed effects model analyses, least squares means tests (i.e., marginal means) were completed for follow up on statistically significant 2-way interaction effects. All analyses to test assumptions and visualize the data were conducted using R version 3.0.2 (R Core Team, 2014). Mixed effects models and least squares means follow up analyses were completed with SAS version 9.2. The alpha level was set at .05 for all tests.

Handling of missing data. Fifteen values were missing from the dataset due to item nonresponse and replaced using predictive mean matching (Schenker & Taylor, 1996). Imputation has been shown to be appropriate for item nonresponse in survey data (Brick & Kalton, 1996).

Table 2.4. Fixed Effects from Mixed Effects Model.

	Total Average	Speech Intelligibility	Ease of Storytelling	Speaker Intelligence	Speaker Communicative Competence	Speaker Confidence	Speaker Friendliness	Listener Comfort	Listener Patience	Listener Effort
Aphasia	1807.16***	734.51***	1617.03***	330.51***	1212.76***	170.34***	394.85***	573.47***	491.07***	850.75***
Fluency	101.93***	0.03	128.48***	5.48*	31.56***	66.81***	20.35***	17.89***	141.09***	37.16***
Listener Group	0.59	1.13	0.15	2.77	1.11	0.37	2.19	3.99	1.40	0.04
Aphasia by LG	7.50**	4.36*	1.45	13.32***	3.53	0.26	1.07	16.96***	3.98	0.38
Fluency by LG	0.03	0.00	0.20	0.77	0.09	0.05	2.89	0.20	0.04	1.71

Note: LG = Listener Group; *p < .05. **p < .01. ***p < .001.

Results

The results of this study show a large impact of aphasia and fluency modification on listener responses to a variety of questions pertaining to speech output, speaker attributes, and listener feelings. Specifically, neurologically healthy speakers received more positive ratings than speakers with aphasia, and aphasic speech samples that were modified to simulate greater fluency were rated more favorably than speech samples that were unmodified (i.e. less fluent; see Figure 2.2).

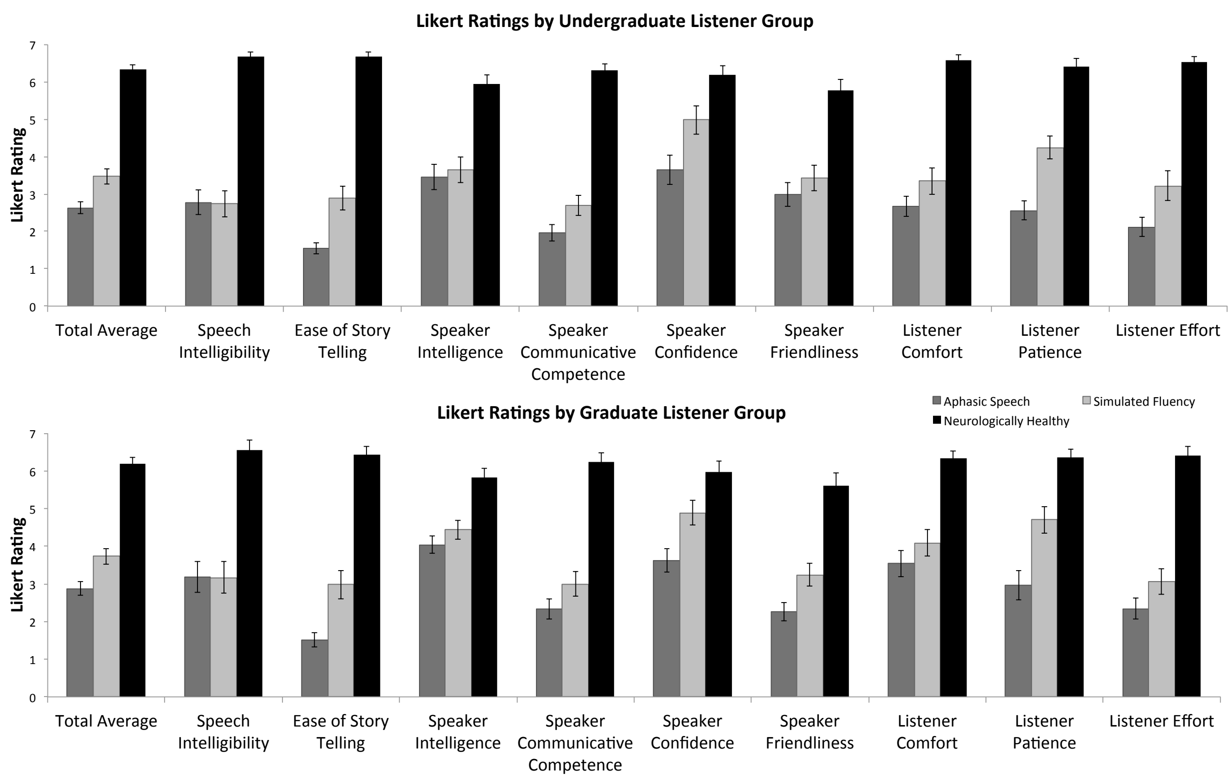

Figure 2.2. Mean Likert ratings of three audio sample conditions by undergraduate and graduate student listeners for all dependent variables. Higher ratings indicate more positive perceptions.

The results for the nine individual questions largely mirrored the overall average, with some minor variations. Therefore, we begin by describing the results for the rating composite and then describe differences among the questions. The questions are grouped by conceptual category (i.e., speech output, speaker attributes, and listener feelings). When we refer to a

Fluency effect in the results or discussion, it always refers to the effect of Fluency nested within the Aphasia condition.

Overall Ratings

The bar graphs in Figure 2.2 show mean Likert ratings across three conditions (i.e., aphasic speech, simulated fluency, and neurologically healthy) for each individual question and their overall average. A separate graph is shown for undergraduate and graduate student listener responses. High ratings indicate more positive perceptions. The highest listener ratings were observed for neurologically healthy speakers, followed by simulated fluent speech of PWA, while lowest ratings were found for unmodified samples of PWA. The difference between the sample conditions was statistically robust, with highly significant effects for the Aphasia and Fluency factors ($p < .001$). The main effect of Listener Group and the Fluency by Listener Group interaction were not statistically significant, but the Aphasia by Listener Group interaction was significant, F (1, 34) = 7.50, $p = .01$. Although both listener groups rated samples from PWA less favorably than those from neurologically healthy individuals, differences between the group's ratings of PWA approached significance ($p = .059$), indicating that graduate students perceived aphasic speech samples more favorably than did undergraduate student listeners (see Figure 2.3).

Speech Output Ratings

In this section we will focus on Likert Ratings of the speech output. The statements related to speech output probed listener perceptions of speech intelligibility and ease of storytelling. Figure 2.2 illustrates the average undergraduate and graduate listener responses for these two statements. Table 4 reports the F statistic and significance for all main and interaction effects related to these two statements.

Aphasia. A statistically significant main effect for Aphasia was found for both questions related to the speech output. PWA were rated less favorably than neurologically healthy speakers on both ease of storytelling, $F\ (1, 34) = 1617.03$, $p < .001$, and speech intelligibility, $F\ (1, 34) = 734.51$, $p < .001$.

Simulated fluency. Simulated fluency yielded more positive perceptions of the ease with which PWA retold the story, as measured by the Fluency effect, $F\ (1, 34) = 128.48$, $p < .001$. However, simulated fluency had no effect on listeners' ratings of speech intelligibility, $F\ (1, 34) = .03$, $p = .86$.

Listener group. The main effect for Listener Group was non-significant for both statements about speech output. The Aphasia by Listener Group interaction was statistically significant for speech intelligibility, $F\ (1, 34) = 4.36$, $p = .04$. Follow up analyses revealed that graduate student listeners rated speech intelligibility of PWA higher than undergraduate listeners ($p = .048$), whereas no difference was found between groups for non-aphasic samples. Figure 2.3 illustrates these differences.

Speaker Attribute Ratings

The Likert statements regarding speaker attributes dealt with listeners' thoughts about the intelligence, confidence, communicative competence, and friendliness of the speaker. The average ratings that undergraduate and graduate student listeners assigned for these four statements are represented in Figure 2.2. Table 2.4 reports all main and interaction effects related to these four statements.

Aphasia. The main effect for Aphasia was statistically significant for all questions referring to speaker attributes. Listeners perceived PWA as less intelligent, $F\ (1, 34) = 330.51$, $p < .001$, confident, $F\ (1, 34) = 170.34$, $p < .001$, competent, $F\ (1, 34) = 1212.76$, $p < .001$, and friendly, $F(1, 34) = 394.85$, $p < .001$, than neurologically healthy speakers.

Simulated fluency. The effect of simulated fluency was also statistically significant for all speaker attribute ratings. Simulated fluency led to more positive perceptions of speaker intelligence, $F(1, 34) = 5.48$, $p = .03$, confidence, $F(1, 34) = 66.81$, $p < .001$, communicative competence, $F(1, 34) = 31.56$, $p < .001$, and friendliness, $F(1, 34) = 20.35$, $p < .001$. There was no interaction among speaker attribute ratings, indicating that the effect of simulated fluency on improving listener perceptions of speaker attributes was independent of listener group.

Listener group. The Listener Group main effect was non-significant for all statements about speaker attributes. Only ratings of speaker intelligence showed a statistically significant Aphasia by Listener Group interaction effect, $F(1, 34) = 13.32$, $p < .001$. Follow up analyses revealed significantly higher ratings of speaker intelligence from graduate compared with undergraduate student listeners ($p = .006$). This difference is illustrated with a boxplot in Figure 2.3. No difference in speaker intelligence ratings was found between listener groups for non-aphasic samples.

Listener Feeling Ratings

The perceptions that listeners had about their own affective response to the samples were measured through statements about listeners' feelings of comfort, patience, and effort. Responses for these three statements can be visualized in Figure 2.2. Main and interaction effects associated with these three statements are reported in Table 2.4.

Aphasia. The Aphasia main effect was statistically significant for all questions referring to listener feelings. Listeners felt less comfortable, $F(1, 34) = 573.47$, $p < .001$, patient, $F(1, 34) = 491.07$, $p < .001$, and felt like they exerted more effort, $F(1, 34) = 850.75$, $p < .001$, while listening to PWA compared with neurologically healthy speakers.

Simulated fluency. The effect of simulated fluency was statistically robust for all ratings related to listener feelings. Listeners reported feeling significantly more comfortable, F (1, 34) = 17.89, $p < .001$, patient, F (1, 34) = 141.09, $p < .001$, and having to exert less effort, F (1, 34) = 37.16, $p < .001$. Fluency by Listener Group interactions were non-significant for all questions pertaining to listener feelings. Thus, the effect of simulated fluency on listener feelings was consistent between listener groups.

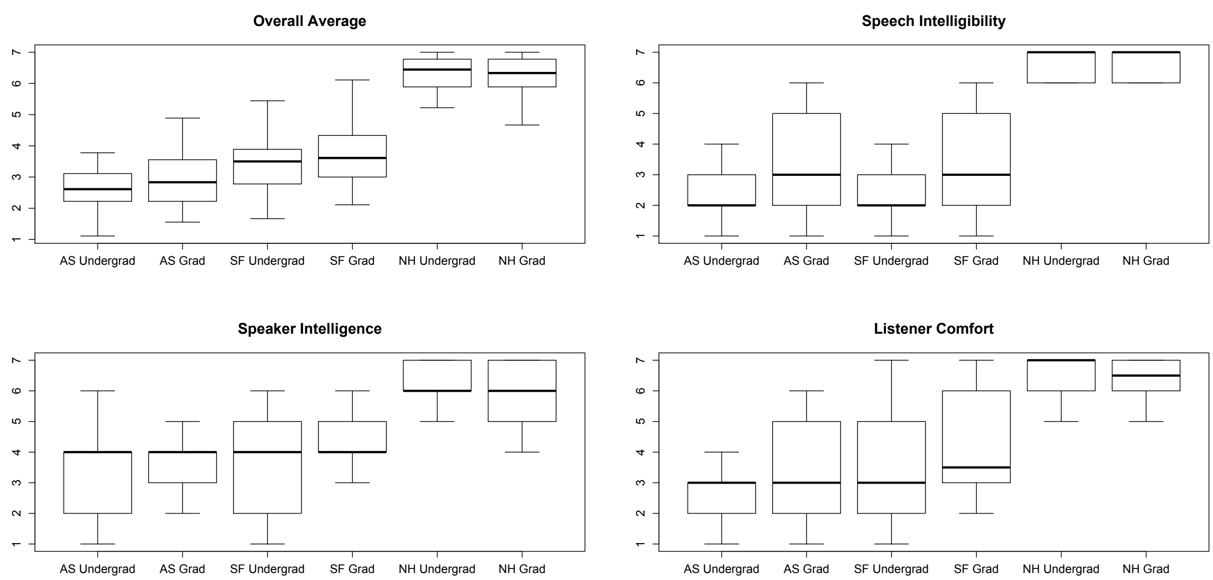

Figure 2.3. Aphasia by Listener Group interactions. This figure shows box-and-whisker plots of the average Likert ratings for all dependent variables with statistically significant Aphasia by Listener Group interaction effects. The plots illustrate the medians and interquartile range with whiskers extending to 1.5 times the interquartile range. AS = aphasic speech; SF = simulated fluency; NH = neurologically healthy. Undergrad = undergraduate student listener group; Grad = graduate student listener group.

Listener group. No significant Listener Group main effects were found for ratings of listener feelings. Aphasia by Listener Group interactions were non-significant for all statements except the one regarding listener comfort, F (1, 34) = 16.96, p = < .001. Consistent with all other Aphasia by Listener Group interactions heretofore reported, follow up analyses revealed higher ratings of comfort from graduate SLP students while listening to PWA ($p < .001$) but no difference between group ratings while listening to neurologically healthy speakers (see Figure 2.3).

Discussion

Findings from this study indicate that (a) samples from PWA yield less favorable listener perceptions of the speech, speaker, and listener feelings than samples from neurologically healthy individuals; (b) graduate student listeners perceive PWA as more intelligible, intelligent, and comfortable to listen to than do undergraduate student listeners; and (c) simulated fluency of aphasic speech positively impacts listener ratings of speech, speaker, and listener feelings. We will discuss each of these findings separately. We will then suggest several clinical implications.

Negative Perceptions of PWA

The first purpose of the present study was to confirm previous reports that listeners perceive PWA less favorably than neurologically healthy adults. Listeners in this study reported less favorable perceptions of PWA across ratings about speech output, speaker attributes, and listener feelings. Negative listener perceptions of PWA may contribute to decreased life participation and ultimately lead to social isolation (Gillespie, Murphy, & Place, 2010; Shadden & Agan, 2004). Professionals have been called upon to help communication partners of PWA change their perceptions to increase opportunities for social interaction (e.g., Kagan, 1998; Simmons-Mackie & Damico, 2007). The present data strongly support this appeal. They also confirm fears often expressed by PWA: being perceived as having compromised intelligence and competence (Kagan, 1998; Parr, 2001). Education and training can help change the public view of aphasia and overcome this stigmatization.

Graduate Student Perceptions of PWA

Graduate student listeners perceived the speech of PWA as more intelligible and PWA as more intelligent and comfortable to listen to than did undergraduate student listeners. Graduate students had been educated about aphasia and exposed to adults with communication disorders. They likely showed less difficulty understanding PWA because they were equipped with strategies derived from experience. Although exposure to PWA alone has shown minimal effects on conversational partners' ability to acknowledge and reveal competence (Kagan et al., 2001), the graduate student listeners in this study had a combination of education and clinical experience. It seems that education combined with experience leads listeners to recognize PWA as intelligent individuals and be more comfortable listening to them. Another potential explanation is that the graduate students were more caring and compassionate toward individuals with disability because of personality characteristics that led them to pursue a profession in healthcare in the first place.

Future studies about listener perceptions should account for factors related to listener sex and age. The listeners represented a younger age range than might typically interact with PWA. In addition, an unequal number of male and female listeners were represented. These considerations may limit the generalization of these findings.

Improved Perceptions of PWA with Simulated Fluency

Our second purpose was to determine the effect of simulated fluency on listener perceptions of PWA. Simulated fluency significantly improved perceptions of listener comfort, listener patience, listener effort, ease of storytelling, speaker confidence, speaker communicative competence, and speaker friendliness regardless of listener group. These findings are consistent with previous reports in the stuttering literature. Susca and Healey (2001, 2002), for example, used similar methods to remove disfluencies (i.e., part-word repetitions, whole-word repetitions, phrase repetitions, prolongations, and pauses) from the speech sample of a person who stuttered. They found that listeners' perceptual ratings were generally more favorable as fluency increased. In the present study, aphasic speech samples were modified to create fluent versions of the narrative while maintaining other common aphasic speech behaviors (e.g., sound distortions, agrammatisms, paraphasias), showing that listener perceptions improved as a function of fluency even when other disordered speech and language behaviors remained unchanged. These improvements were found across a variety of questions related to speech output, speaker attributes, and listener feelings.

Simulated fluency improved listeners' perception of how easy it is for PWA to communicate through a story retell task. This result could potentially be an artifact of differing story lengths, as the modified samples were, on average, more than four minutes shorter than the original samples. It may also be that listeners' feelings (i.e., comfort, patience, and effort) influence their perception of how easily the speaker tells the story. Thus, if listeners' emotional reaction to the speech improves, we might expect them to perceive the story as being told more easily. In addition to the nine Likert statements, three open-ended questions were asked of listeners, which may add insight into qualitative aspects of their ratings. Future exploration and report will include qualitative analysis of these responses.

It is notable that no significant difference was found in listeners' perception of intelligibility for simulated fluent compared with aphasic speech samples. Because the simulated fluent samples contained the same sound and word productions as the paired aphasic speech sample we would not expect intelligibility to improve per se. The contrast between ease of story-telling and speech intelligibility seems to appropriately pinpoint the importance of considering social variables such as listener perceptions. Increasing speech fluency may not improve how well the speech of PWA is understood, though it may improve how PWA are perceived and increase their opportunities for communicative interaction.

Speakers from simulated fluent samples were perceived as more confident, competent, and friendly. This is particularly important given that listener acknowledgement of competence when communicating with PWA is thought to have a significant impact on communicative interactions (Kagan et al., 2001; Kagan, 1998). Perceptions of competence and intelligence also highlight an area of direct concern for many people with aphasia during real-world interactions (Kagan, 1998; Le Dorze et al., 2014; Parr, 2001). PWA who are viewed as more competent, confident, and friendly will likely receive and take advantage of more opportunities for social interaction. Of note is the wording of the question regarding competence, which was a rating of competence as a speaker and not competence as a person. It is possible that listeners' responses to the question regarding competence might have been different had they been asked about the person's general competence rather than communicative competence.

Listeners felt more comfortable and patient, and they expended less effort listening to simulated fluent speech compared with unmodified aphasic speech. This is consistent with findings from Lasker and Beukelman (1999), who found that peer listeners (i.e., older adults over age 60) reported a greater level of comfort with shorter message duration. Decreased comfort, patience, and effort felt by the listener may cause them to limit their interaction with PWA. Due to its impact on the self-reported affective response of listeners, increased fluency may yield more favorable and more numerous social interactions.

We acknowledge that simulated fluency is not the same as fluent speech produced naturally by PWA. Digital manipulation of speech is useful because it allows us to glimpse possible outcomes of therapeutic targets—in this case, improved speech fluency—without providing treatment. Because disfluent verbal output may be the result of a variety of aphasic impairments, treatments that increase speech fluency might simultaneously impact other impaired behaviors. On the other hand, treatments that target behaviors such as naming and grammatical encoding might also affect speech fluency—both positively and negatively. One of the strengths of this study is the robust effect of speech fluency on listener perceptions.

Clinical Implications

Findings from this study suggest several clinical applications related to (a) targeting speech fluency and evaluating social treatment outcomes, (b) targeting conversation partners' perceptions through direct training, and (c) using simulated fluency in treatment.

This study showed that speech fluency of PWA affects listener perceptions. Fluency is a viable treatment target for PWA that has been manipulated successfully via script training and choral speech (Fridriksson et al., 2012; Goldberg, Haley, & Jacks, 2012; Youmans et al., 2005; Youmans, Youmans, & Hancock, 2011). Additional research from our laboratory has shown promising results for increasing fluency in PWA using masked auditory feedback (Jacks & Haley, 2015). In particular, we have found that some people with aphasia and/or apraxia of speech increase their rate of speech and decrease disfluencies while listening to noise. While these results have been achieved in a controlled laboratory setting and over a limited period of time, the technique has the potential to achieve lasting gains in combination with behavioral treatment. The outcomes of increased speech fluency extend beyond behavioral change alone and include important social outcomes (i.e., improved listener perceptions) that should not be ignored. This study, therefore, supports speech fluency as a socially valid treatment target.

Treatment targets in general should be evaluated by a combination of behavioral and social impact. Social outcomes have most often been associated with approaches that seek to support communication for PWA by creating environmental facilitators (e.g., conversation partner training). It is less common for approaches that target speech behavior of PWA (e.g., impairment-based approaches) to emphasize social outcomes. Although not a treatment study, this research showed that digitally altered speech behavior has significant impact on listener perceptions, suggesting that targeting behavior can also improve interactions with the social environment.

Social outcomes are often overlooked because they can be difficult to measure (Kagan et al., 2001). In this study we successfully measured listener perceptions as an effect of digitally modified speech. Measurement of societal impressions could reasonably be included as an outcome in future intervention studies. Given the plethora of treatment approaches, strategies, and techniques for aphasia intervention, endorsement of treatment methods should move beyond those that merely show behavioral change to those whose targeted behavioral change might have the greatest social impact.

Targeting conversation partners' perceptions through direct training is also important. This study found a clear disparity between listeners' perceptions of PWA and their neurologically healthy peers. It also found that graduate student listeners perceived PWA more positively in some respects than undergraduate students. Communication partner training is a form of evidence-based treatment that often includes work on improving perceptions by directly training the communication partners of PWA (Turner & Whitworth, 2006). For example, one partner training program (Supporting Partners of People with Aphasia in Relationships and Conversations; Lock et al., 2001) gives special attention to targets that trigger negative communication partner responses and another (Supported Conversations for Adults with Aphasia; Kagan et al., 2001) trains partners to acknowledge the competence of PWA by demonstrating an attitude of support, encouragement, and patience. Improving listeners' perceptions of PWA through direct education and training of communication partners should continue to be addressed. Communication partner training could include education about the impact of disfluencies on perceptions and training of specific attitudes that help communication partners tolerate disfluencies (e.g., patience, waiting, listening).

Simulated fluency of aphasic speech might also be used in intervention for treatments targeting behavior and personal identity. For example, a simulated fluent sample could act as a means of self-cueing for repetition-based treatments such as script training (Cherney, Halper, Holland, & Cole, 2008; Lee, Kaye, & Cherney, 2009). Rather than repeating another person's productions, a simulated fluent sample would allow PWA to be their own model, potentially increasing autonomy and motivation for these interventions. In addition to using simulated fluency to target speech behavior, simulated fluency might be a useful tool for enhancing the personal identity of PWA. Findings from this study indicate that listeners' judgments about the personality and attributes of PWA become more positive when the speech of PWA is made more fluent. While more favorable listener perceptions are likely to aid in establishing a more positive social identity, it would also be interesting to learn if hearing simulated fluent samples of their own speech improves self-perceptions of PWA. It seems obvious that people would think they sound better when made more fluent—for example, PWA have shown improved self-ratings of their speech following an increased speaking rate (Youmans et al., 2011)—but would PWA also have more positive perceptions of their own ability to produce speech successfully? Would they view themselves more positively? Improving the compromised self-concept and personal identity of PWA is essential (Shadden, 2005). If simulated fluency led to more positive self-perception it might be used as a tool to support confidence and better conceptualize the personal outcomes of speech production training. It is possible that PWA have to actually speak more fluently to enjoy gains in self-concept rather than simply hearing themselves as more fluent, however this is a question that is yet to be studied. Future research should investigate the effects of simulated fluency on self-perceptions of PWA and probe its effect on self-concept and personal identity.

Conclusion

We have learned from the current study that greater fluency is associated with more positive listener perceptions of PWA. These findings, however, should be interpreted with caution. While simulated fluency led to improved listener perceptions, samples were not controlled for duration. It is possible that part of the effect of simulated fluency on listener perceptions was due to sample duration. Future studies could control for the effect of sample duration. Future research should also expand this work by considering motivation and self-perception of PWA in response to simulated fluent speech as well as the utility of simulated fluency to act as a self-cueing mechanism for PWA. There is a need to investigate the social impact of various impairment-based interventions within the field of aphasiology. Increased speech fluency is one behavior that has been shown to improve listener perceptions of people with nonfluent aphasia.

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CHAPTER 3: EFFECTS OF SOCIAL AND COGNITIVE DEMANDS ON STORY RETELL IN APASIA

Introduction

The ultimate goal of aphasia therapy is to improve everyday communication. Everyday situations in which people with aphasia (PWA) communicate, however, often present greater cognitive and social demands than those typically experienced in a clinical setting. Two examples are background noise and communication partner attitudes, which PWA find particularly detrimental to their communication and life participation (Baylor, Burns, Eadie, Britton, & Yorkston, 2011; Garcia, Barrette, & Laroche, 2000; Hayward & Bixley, 2013). Background and other environmental noises can tax the cognitive system by requiring increased attention. Communication partner attitudes influence the social environment and can affect a speaker's emotional response (Lepore, Allen, & Evans, 1993; Thorsteinsson & James, 1999). In the present study, we investigated the effects of cognitive and social demands on the story retell performance of PWA. Cognitive demands were manipulated using a divided attention task and social demands were manipulated through nonsupportive nonverbal communication partner feedback. Although cognitive and social demands are different they might have similarities in how they affect story retell performance of PWA.

Attention and Cognitive Demands

The role of attention in aphasia has been a topic of discussion for decades (e.g., Hula & McNeil, 2008; McNeil, Odell, & Tseng, 1991; Murray, 2002). Research has repeatedly demonstrated that PWA perform worse than their neurologically healthy peers when their attention is divided between a primary and secondary task (e.g., Hula, McNeil, & Sung, 2007;

LaPointe & Erickson, 1991; Murray, 2000; Murray, Holland, & Beeson, 1998; Tseng, McNeil, & Milenkovic, 1993). For example, PWA have shown greater interference on primary and secondary tasks when identifying a target word among foils and simultaneously sorting cards (LaPointe & Erickson, 1991) and when performing semantic judgment and lexical decision tasks simultaneously or while distinguishing between two tones (Murray, Holland, & Beeson, 1997).

Although most of the aphasia literature investigating the effects of cognitive demands via divided attention has focused on auditory processing, the role of attention on speech production in aphasia has also been noted. These detrimental effects have been shown through decreased accuracy and slower response times on phrase completion tasks when simultaneously distinguishing between two tones; decreased accuracy and slower response times were also noted in these experiments for the secondary tone discrimination task (Hula et al., 2007; Murray, 2000). Murray and colleagues (1998) replicated these effects during running speech using a picture description task. They found that simultaneously performing auditory discrimination and picture description tasks decreased speech productivity and efficiency and increased word-finding errors in 14 people with mild aphasia. Neurologically healthy controls, on the other hand, displayed no difference in spoken language performance across conditions. Similar to previous studies, divided attention not only interfered with picture description but also the secondary tone discrimination task.

So far, studies of language production interference have only examined variables related to language content and accuracy. With regard to secondary tone discrimination task, however, both accuracy and speed have been considered (see e.g., Murray, 2000; Murray et al., 1998). When dividing their attention between speech production and tone discrimination tasks, people with no aphasia increased their response time on the tone discrimination task in order to maintain high accuracy. PWA, on the other hand, not only performed the tone discrimination task more slowly but also less accurately. Given the dual task effects on speed-accuracy relationships during secondary task performance and the importance of both content and fluency during speech production, we investigated dual task effects on delivery speed and content accuracy during story retell.

Communication Partners and Social Demands

Research has increasingly emphasized the role of communication partners in aphasia rehabilitation (Hopper, Holland, & Rewega, 2002; Kagan, 1998; Kagan, Black, Duchan, Simmons-Mackie, & Square, 2001; Lock et al., 2001) and the efficacy of programs that train partners in supportive communication behaviors (see Simmons-Mackie, Raymer, Armstrong, Holland, & Cherney, 2010; Simmons-Mackie, Raymer, & Cherney, 2016 for a review of these studies). In these programs, communication partners are most often trained to facilitate communication through verbal and instrumental supports as well as encouraging nonverbal feedback. For example, communication partners may be trained to "acknowledge competence," which includes demonstrating an overall listening attitude through supportive nonverbal feedback as well as talking with a natural tone, rate, and loudness (Kagan, 1998; Kagan et al., 2001).

Improved communicative performance for PWA as the result of supportive verbal and nonverbal communication partner behaviors has been shown via questionnaires, subjective ratings, and qualitative analysis (Simmons-Mackie et al., 2010, 2016). Kagan et al. (2001) used a subjective rating scale where a rater viewed conversational interactions and scored the PWA according to their level of participation in conversational interaction (i.e., social connection) and transaction (i.e., exchange of information). Participants with aphasia were rated significantly higher on these measures when talking with a supportive communication partner. Using a similar rating scale, Rayner and Marshall (2003) showed that training volunteers to support the communication of PWA led to increased participation by PWA. Some studies have more directly measured spoken language of PWA following communication partner training (e.g., Boles, 1998; Simmons-Mackie, Kearns, & Potechin, 2005) but, in addition to training communication behaviors of the partner, they also trained PWA. The outcomes found in these studies, therefore, cannot be interpreted as resulting from increased communication partner support alone.

While most previous work has focused on supportive conversation techniques, the present study addressed nonsupportive partner behaviors. The effect of nonsupportive partner behaviors on the communication of PWA is of interest because (a) PWA frequently interact with partners that reportedly fail to support their communication (Dalemans, de Witte, Wade, & van den Heuvel, 2010; Parr, 2007) and (b) PWA might have an emotional response to nonsupportive partners (see e.g., Lepore et al., 1993). We hypothesized that talking with a nonsupportive communication partner would impact speakers' emotional response by increasing their psychological stress and, in turn, potentially affect the content and fluency of their spoken language.

Stress in Aphasia

Stress in aphasia has been measured in two ways: psychological measures (i.e., self-report rating scales) and physiological measures (i.e., cortisol reactivity and heart rate variability). While findings regarding their physiological stress response have been equivocal, PWA have been shown to report greater psychological stress than controls following a linguistic task (Cahana-Amitay et al., 2015; Laures-Gore, DuBay, Duff, & Buchanan, 2010; Laures-Gore, Heim, & Hsu, 2007). Cahana-Amitay et al. (2011) have argued that anticipation of errors or linguistic failure might cause a heightened affective response for PWA during language use. Research has shown discrepancies between physiological stress response and psychological stress during a language task (see e.g., Laures-Gore, DuBay, Duff, & Buchanan, 2010; Laures-Gore, Heim, & Hsu, 2007), making the relationship between stress and language in aphasia difficult to interpret. There is, nevertheless, some indication that stress response might influence spoken language.

The effects of stress response on spoken language have been shown in healthy young adults and a case-study of one person with mild aphasia. The young adults demonstrated greater pause time during a stressful speech task (i.e., defending themselves in front of a store manager after being accused of shoplifting) compared with a control task (i.e., summarizing a general interest travel article). Their pause time (i.e., seconds spent in silent pauses) also correlated with greater heart rate and cortisol response during the final minute of the stressful speech task (Buchanan, Laures-Gore, & Duff, 2014). In the case-study, one participant with mild aphasia performed a free discourse task under typical assessment conditions and when anticipating having to give a speech to a group of experts following the session (i.e., high stress). The participant produced a greater percentage of extended and filled pauses per utterance in the high stress condition (Cahana-Amitay et al., 2015). While these findings suggest that acute stress might influence speech production, we are not aware of any study that has systematically investigated the direct effects of nonsupportive feedback on discourse production in aphasia or determined how nonsupportive feedback differentially affects PWA compared with controls.

Potential Links between Attention and Nonsupportive Partner Feedback

Distraction theories posit that affective reactions can divert attention from a task, essentially creating a dual task environment (DeCaro, Thomas, Albert, & Beilock, 2011). In other words, people might perform more poorly during social challenge because they are allocating attentional resources to worries about the task and its consequences. Cahana-Amitay et al. (2011) suggested that this link between attentional resources and emotion regulation might be particularly pertinent for PWA whose "concern about impaired language performance reduces [their] ability to attend to the language task at hand" (p. 599).

Although cognitive and social demands are different in nature, they may influence performance through a similar mechanism. Most divided attention research in aphasia has been interpreted in light of resource-capacity models of attention. These models suggest that people have a central reserve of cognitive resources for which different activities compete. Resources must therefore be allocated to fit within this capacity or performance will deteriorate (Wickens, 1981, 2008). In accordance with these models, the significantly greater breakdown in performance that PWA experience during cognitively demanding tasks has been interpreted to either signify a decreased attentional capacity or an impairment in resource allocation (McNeil, Odell, & Tseng, 1991; Murray et al., 1998; Murray, 2000; Wickens, 2008). A resource capacity model might be applied to task performance during both cognitively and socially demanding situations.

Methods for Manipulating Cognitive and Social Demands

The dual task paradigm has been used to study both focused and divided attention in aphasia (Hula et al., 2007; Murray, 2000; Murray et al., 1997, 1998). Under focused attention, stimuli for two tasks are presented but participants are asked to focus on one task and ignore the other. Under divided attention, participants are asked to perform both tasks simultaneously; however, differing instructions might be given about which task to prioritize. Eye tracking is another method that has been proposed for measuring attention in aphasia, but the use of this method is limited to tasks that use visual stimuli (Heuer & Hallowell, 2015). In the present study, we manipulated attention via a dual task paradigm that required participants to divide their attention between retelling a short story and discriminating between two tones. We used a tone discrimination task to divide attention because (a) it has been previously used in connection with running speech and (b) to simulate background noise that can cause everyday cognitive challenge during communication.

Past studies have manipulated social demands during communication via nonverbal feedback from a communication partner: facial expression, eye contact, body posture, etc. (Brundage et al., 2006; Hilmert, Christenfeld, & Kulik, 2002; Lepore, Allen, & Evans, 1993). Participants in these studies were asked to talk with real or virtual communication partners that demonstrated nonsupportive and supportive nonverbal behaviors. For example, communication partners that demonstrated nonsupportive feedback did not smile or nod (Lepore et al., 1993) and lost eye contact with the speaker (Brundage, Graap, Gibbons, Ferrer, & Brooks, 2006). Using this manipulation method, nonsupportive partner feedback has been shown to increase physiological stress response in healthy individuals (Lepore et al., 1993; Thorsteinsson & James, 1999) and lead to decreased speech fluency in people who stutter (Brundage et al., 2006; Brundage & Hancock, 2015). Given the precedent of this method, its potential link with attention, and its overlap with nonverbal behaviors emphasized in communication partner training programs for aphasia, we used a similar manipulation.

Purpose

The aims of the present study were to (1) identify the effects of social and cognitive demands on psychological stress for people with and without aphasia, (2) determine if both social and cognitive demands interfere more with speech productivity and fluency for people with aphasia than for their neurologically healthy peers, and (3) explore the relationship between interference caused by cognitive and social demands during story retell. Due to the vulnerability that PWA have shown to deficits in attention and the potential for nonsupportive partners to increase psychological stress, we hypothesized that dual task performance and communication with a nonsupportive partner would interfere with accuracy and speed more for PWA than for neurologically healthy controls. We also hypothesized a positive correlation between interference caused by social and cognitive challenge due to a shared attention allocation mechanism.

Method

Participants

Thirty-three people participated in all parts of the present study. Twenty-one participants had a history of aphasia as the result of brain injury and twelve were control participants with no history of stroke. An additional three participants with aphasia were evaluated but excluded from the study due to inability to complete the story retell task. This study was approved by the UNC-CH Institutional Review Board.

Participants with aphasia. The group of participants with aphasia included 8 males and 13 females. The average age of these participants was 59 years (range = 32 to 81 years). All except one had completed at least some college with the average years of education reported as 16 (range = 12 to 22 years). All participants passed a hearing screening or—in the case of two whose hearing was not tested—reported normal hearing. Participants also passed a vision screening and three were found to have loss to some portion of their right visual field (A04, A08, A16). All participants had aphasia as the result of a stroke except one whose aphasia was the consequence of a traumatic brain injury and another who had aphasia as the result of multiple sclerosis. All were in the chronic stage of aphasia recovery—at least 19 months post-onset.

Participants with aphasia completed a test battery to evaluate their language, verbal working memory, overall cognitive aptitude, mood, and communication confidence and apprehension. Tests included the Western Aphasia Battery Revised (WAB; Kertesz, 2006), the rhyming triplet judgment and synonym triplet judgment tasks from the Temple Assessment of Language and Short-term memory in Aphasia (TALSA; Martin, Kohen, & Kalinyak-Fliszar, 2010; Martin, Kohen, Kalinyak-Fliszar, Soveri, & Laine, 2012), the Test of Nonverbal Intelligence, Fourth Edition (TONI-IV; Brown, Sherbenou, & Johnson, 2010), the Geriatric Depression Scale short form (GDS; Yesavage & Sheikh, 1986), the Personal Report of Communication Apprehension (PRCA-24; McCrosky, Beatty, Kearney, & Plax, 1985), and the Communication Confidence Rating Scale (CCRSA; Babbitt, Heinemann, Semik, & Cherney, 2011; Cherney, Babbitt, Semick, & Heinemann, 2011). Scores and other demographic information for each participant are reported in Table 3.1.

Because the severity of language impairment in the participants with aphasia encompassed a large range from moderate to very mild, we divided the group by severity. The moderate group included participants with a WAB Aphasia Quotient (AQ) score of less than 80 and the mild group included all participants with a WAB AQ greater than or equal to 80. Four of these participants scored in the non-aphasic range (i.e., AQ > 93.8); they all, however, had a history of aphasia and reported continued word-finding difficulties in their everyday communication. After dividing the group, the average age of participants with mild and moderate aphasia was 62 (range = 33 to 81) and 56 (range = 32 to 72) respectively. The average years of

Table 3.1. Demographic and Assessment Information for Participants with Aphasia.

ID	Sex	Age	Edu	TPO (yy;mm)	Etiology	TONI -IV	WAB		TALSA		GDS	CCRSA	PRCA-24	Screenings		
							AQ	Classification	Rhyming Total (%)	Synonym Total (%)				Dys	LA	OA
A01	F	58	20	14;00	Stroke	92	87.00	Anomic	76.67	80.00	1	72	61	8	31	21
A02	F	56	14	4;05	Stroke	88	90.70	Anomic	83.33	72.50	4	63	59	11	48	39
A03	F	81	15	5;07	Stroke	94	92.70	Anomic	86.67	87.50	0	55	46	8.5	39	39
A04	M	33	16	5;11	TBI	92	87.60	Anomic	56.67	62.50	5	90	34	10.5	50	44
A06	F	48	17	18;04	MS	95	77.80	Transcortical Motor	76.67	85.00	2	76	93	12.5	50	50
A08	M	56	16	2;01	Stroke	128	100.00	NABW	100.00	97.50	5	78	94	12.5	50	48
A09	F	59	16	1;10	Stroke	88	89.90	Anomic	80.00	90.00	1	80	71	13	50	47
A10	F	72	12	8;00	Stroke	103	72.20	Broca	76.67	75.00	0	84	60	9	46	32
A11	F	65	15	7;07	Stroke	119	84.30	Anomic	80.00	95.00	2	84	44	10	50	44
A12	F	61	16	11;03	Stroke	90	74.10	Anomic	80.00	80.00	1	78	48	10.5	27	27
A13	F	61	13	5;04	Stroke	101	67.50	Broca	73.33	62.50	5	79	69	10	44	32
A14	M	61	20	5;08	Stroke	93	67.00	Wernicke's	33.33	72.50	3	55	56	13	47	42
A16	M	60	22	4;08	Stroke	107	95.40	NABW	83.33	92.50	3	94	46	12	50	49
A17	F	72	18	9;09	Stroke	95	82.80	Anomic	70.00	87.50	2	81	70	9.5	50	29
A18	F	71	16	18;01	Stroke	104	94.00	NABW	96.67	97.50	1	70	66	13	50	50
A19	M	72	18	8;02	Stroke	95	97.40	NABW	100.00	97.50	4	72	73	12	49	41
A20	M	60	18	8;07	Stroke	95	75.00	Anomic	66.67	85.00	4	74	61	13	47	43
A21	F	32	13	11;11	Stroke	95	63.70	Conduction	30.00	50.00	0	99	43	10	50	34
A22	F	56	16	12;09	Stroke	105	52.10	Broca	30.00	60.00	2	67	80	11	44	43
A23	M	64	18	3;02	Stroke	95	72.70	Broca	70.00	65.00	1	75	57	8.5	48	35
A24	M	48	19	1;07	Stroke	109	68.20	Broca	83.33	90.00	3	86	36	11	47	45

Note. Age and Education are reported in years. Edu = Education; TPO = time post-onset; TONI-IV = Test of Nonverbal Intelligence 4th Edition; WAB = Western Aphasia Battery-Revised; AQ = Aphasia Quotient; TALSA = Temple Assessment of Language processing and Short-term memory in Aphasia; GDS = Geriatric Depression Scale; CCRSA = Communication Confidence Rating Scale; PRCA-24 = Personal Report of Communication Apprehension; Dys = Dysarthria; LA = limb apraxia; OA = oral apraxia. Lower dysarthria, limb apraxia, and oral apraxia ratings indicate greater presence of dysarthria or apraxia respectively.

education was 17 (range = 14 to 22) for participants with mild and 16 (range = 13 to 20) for participants with moderate aphasia.

Control participants. The group of control participants included five males and seven females. The average age of participants was 58 years (range = 33 to 81) and the average years of education was 16 (range = 12 to 21). All participants passed a vision screening. One control participant (C11) reported a congenital hearing problem but was included in the study because he passed a hearing screening at 25 dB in the left ear (0.5, 1, 2, 4, 6, and 8 KHz) and 45 dB in the right ear (0.5, 1, and 2 KHz). All other control participants passed a hearing screening at 40 dB for 0.5, 1, and 2 KHz (Weinstein & Ventry, 1983). Control participants also completed the PRCA-24 and the Questionnaire to Verify Stroke-free Status (QVSFS; Jones, Williams, & Meschia, 2001). Their scores and demographic information are shown in Table 3.2.

Table 3.2. Demographic and Assessment Information for Control Participants.

ID	Sex	Age	Education	QVSFS	PRCA-24
C01	F	71	16	0	60
C02	M	70	21	0	33
C03	F	50	16	0	45
C04	F	55	13	0	44
C05	F	33	18	0	43
C06	F	81	18	0	48
C07	F	34	16	0	74
C08	F	60	12	0	63
C09	M	64	18	0	26
C10	M	66	18	0	39
C11	M	48	14	0	84
C12	M	61	16	1	66

Note. Age and Education are reported in years. QVSFS = Questionnaire for Verifying Stroke-Free Status; PRCA-24 = Personal Report of Communication Apprehension.

Procedures

Narrative discourse task. Participants completed a narrative discourse task to approximate everyday communication while controlling for content. The stimuli included 4 stories designed to assess narrative production in aphasia (Doyle et al., 1998). These stories are matched for content (i.e., number of words, number of sentences, number of subordinate clauses and mean sentence length) and complexity (i.e., ratio of clauses to T-units, listening difficulty, and number of unfamiliar words) and are comparable to other commonly used discourse elicitation methods across various measures of verbal productivity, information content, and verbal disruptions (McNeil et al., 2007). Participants were presented with both auditory (i.e., an audio recording of a male speaker telling the story) and visual (i.e., six pictures that went along with the story) stimuli, after which they were asked to retell the story without visual or audio support. Each participant practiced the narrative discourse task by telling one practice story to the investigator before beginning the experiment. The story stimuli were pseudorandomly assigned across conditions so that each story was told four to seven times during each experimental condition by PWA and three times during each experimental condition by controls.

Experimental conditions. Three experimental conditions were presented to all participants enrolled in the study: (1) supportive partner (i.e., single task with a supportive communication partner), (2) dual task (i.e., dual task with a supportive communication partner), and (3) nonsupportive partner (single task with a nonsupportive communication partner). The single task with a supportive communication partner served as the baseline condition. The dual task condition increased cognitive demands by causing the participants to divide their attention between retelling the story and tone identification. During the nonsupportive partner condition, communication partners demonstrated behaviors associated with disinterest (Glynn, Christenfeld, & Gerin, 1999; Hilmert et al., 2002; Lepore et al., 1993). We describe each condition below. Appendix 3.A contains the specific protocol that was followed.

Supportive communication partner. During the supportive partner condition, participants told a story to a student who had been trained to demonstrate behaviors shown to buffer the effects of social stress and support communication in aphasia (Kagan, 1998; Lepore et al., 1993). These behaviors included a brief introduction—made with normal vocal tone, rate, and loudness. For participants with aphasia, the introduction contained a verbal acknowledgement by the partner of the participant's competence. When the participant retold the story, the supportive partner demonstrated good eye contact, positive facial expressions and head nods, an open body posture, and verbal affiliatives (i.e., "mmhm," "ok," "I see," etc.; Kagan et al., 2001; Simmons-Mackie & Kagan, 1999; Turner & Whitworth, 2006). Participants were told that the student would be asked to judge how well they retold the story. For a complete description of how this condition was implemented, see Appendix 3.A.

Tone discrimination dual task. During the dual task condition, participants simultaneously performed a tone discrimination task while retelling the story. During this condition, participants heard high (2000 Hz) and low (500 Hz) tones presented randomly throughout the story retell and were instructed to push a blue-colored button when they heard the low tone and a red-colored button (Ablenet Inc., 2018) when they heard the high tone. The timing of tone presentations was randomized at an average interval of six seconds. Prior to the dual task condition, participants practiced identifying tones in isolation for approximately two minutes to ensure they understood the task and to obtain baseline measures of accuracy and reaction time. Tones were presented and discrimination accuracy and reaction times were tracked using a custom Matlab script.

Nonsupportive communication partner. In the nonsupportive partner condition, PWA told a story to a student who had been trained to demonstrate behaviors that are contrary to supported communication in aphasia and have been suggested to induce social stress (Lepore et al., 1993; Thorsteinsson & James, 1999). A handful of studies have used a modified Trier's Social Stress Test (Kirschbaum, Pirke, & Hellhammer, 1993) to induce stress in PWA by asking them to speak about their most recent job in front of a stranger (Laures-Gore et al., 2010; Laures-Gore, Heim, et al., 2007) or prepare a speech about their most recent job to be given to three "expert evaluators" (Cahana-Amitay et al., 2015). To our knowledge, this is the first study that has manipulated stress in PWA via communication partner feedback. This method was used in the present study because we were not only interested in inducing stress but also understanding how communication partner support and nonsupport affect communication.

The behaviors of the nonsupportive communication partner were opposite those demonstrated by the supportive partner. During their introduction, the nonsupportive partner spoke with a patronizing tone, slow rate, and greater than typical loudness. They did not verbally acknowledge the participant's competence and when listening to the story demonstrated poor eye contact, neutral facial expression, and closed body posture. They did not use verbal affiliatives (e.g., "mmhm," "ok") or head nods while listening to the story.

Communication partners and fidelity. Four graduate students in speech-language pathology were trained to demonstrate both supportive and nonsupportive behaviors (see Appendix 3.B). These students were observed practicing the experimental protocol with undergraduate student volunteers and the two who most consistently followed the protocol were selected as the communication partners for the experiment. Both were female and participated in the study to fulfill part of their graduate research experience. The two students were pseudorandomly assigned as the supportive or nonsupportive partner for each participant. One student was the supportive partner 10 times and the other 11 times for the participants with aphasia and each was the supportive partner 6 times for the control participant group. Each story retell was recorded with a Canon Vixia HF R500 camcorder facing the communication partner.

A student research assistant viewed all video recordings and completed interval coding of the partner behaviors for each 10 s segment by marking whether eye contact was appropriate or inappropriate, body posture was open or closed, and affiliatives (i.e., smiles and head nods) were present or not present. The coder also judged whether the partner had demonstrated a listening attitude during the interval. Coding was used to calculate an average support score ranging from zero to four with zero indicating an absence of supportive behaviors and four indicating all supportive behaviors present. The two communication partners were judged to have equal fidelity with the protocol. The overall average ratings were 3.86 and 3.84 when acting as the supportive partner and 0.14 and 0.17 when acting as the nonsupportive partner.

The research assistant also coded behaviors during the communication partner's introduction by judging whether the communication partner introduced herself using a patronizing voice and—during introductions to participants with aphasia—whether she acknowledged the competence of the communication partner as part of the introduction. These behaviors were again coded so that higher scores reflected supportive behaviors and lower scores indicated an absence of these behaviors but this time scores ranged from zero to two. Communication partners demonstrated good fidelity during their introductions: scores for nonsupportive partner introductions were 0.00, indicating no variation from the protocol; for supportive partner introductions, scores were 2.00 and 1.78. The variability in this score was due to one of the communication partners failing to verbally acknowledge the competence of four participants with aphasia when introducing herself. This occurred with some of the early participants in the experiment and, when asked about this variation, the student indicated that she simply forgot that this was part of the protocol.

Dependent Variables. The main dependent variables were self-rated psychological stress and speech performance. Secondary task performance was measured via tone discrimination accuracy and reaction times in isolation and during the concurrent story retell.

Psychological stress. After each story retell, the communication partner left the room and the investigator re-entered and guided the participants in completing a brief questionnaire to assess psychological stress. The measure was obtained using four Likert statements rated from 1 (not at all) to 5 (very much): (1) retelling the story was stressful, (2) retelling the story was pleasant, (3) I felt nervous when retelling the story, and (4) I was calm while retelling the story (see Hilmert et al., 2002). When administered to participants with aphasia, questions were read aloud and responses were verified to ensure that the participant understood and responded appropriately. Prior to analysis, psychological stress questions 2 and 4 were reverse coded so that low numbers signified less psychological stress and high numbers indicated greater psychological stress. The four questions were then averaged to obtain the overall psychological stress score.

Speech performance. Primary dependent variables included five measures of spoken language that accounted for productivity, efficiency, and fluency. Content was analyzed using broad orthographic transcription in CHAT format (MacWhinney, 2000) and disfluent behaviors were coded in Praat (Boersma & Weenink, 2014) in order to reference the acoustic signal. The five measures of interest were taken from utterance, word, correct information unit, and disfluency counts.

A trained undergraduate research assistant and the author transcribed the samples in CHAT. Utterance boundaries were identified as outlined in the CHAT manual (MacWhinney, 2000). Word counts obtained from the computerized language analysis (CLAN) software included all intelligible words except fillers or phonological fragments. The research assistant re-transcribed approximately 20% of the samples to check reliability, which was computed using Pearson's correlations. Intrarater reliability for word and utterance counts was $r = .99$ and $r = .91$ respectively; interrater reliability for word counts was $r = .99$ and for utterance counts was $r = .80$. After the CHAT transcription was completed, the same research assistant analyzed the transcription to determine the number of correct information units (CIUs; Nicholas & Brookshire, 1993). After counting CIUs for all story retell samples, the research assistant and first author were randomly assigned 20% of the samples to re-count. Both intra and interrater reliability for CIU counts were high (i.e., $r = .99$). CIUs include all words that are intelligible in context, accurate, relevant, and informative. Speech productivity was measured as the number of CIUs produced. Speech efficiency was calculated as the ratio of number of CIUs to words and accounts for the proportion of words that contribute to the communicative value of the discourse. Speech rate was calculated as the number of words produced per minute.

Disfluent behaviors that impede the flow of speech (i.e., simple repetitions, extended pauses, and filled pauses) were coded in Praat (Boersma & Weenink, 2014) using acoustic segmentation. Repetitions included sound, syllable, and monosyllabic word repetitions. Productions were only coded as repetitions if the same phonemes were produced without any other intervening production. All pauses or filled pauses equal to or greater than one second were coded as silent pauses or filled pauses. The author and a graduate student research assistant each coded approximately half of the samples for disfluencies. They each re-coded 20% of the samples, which were selected randomly. Intrarater reliability for the research assistant was r = .87 for repetition counts and r = .98 for pause counts. For the first author, intrarater reliability was r = .94 for repetition counts and r = .99 for pause counts. The author also coded 20% of the samples that the graduate student had originally coded, which were selected randomly: interrater reliability was r = .83 for repetition and r = .94 for pause counts. Repetition and extended pause counts were used to calculate the percentage of disfluent words (i.e., proportion of repetitions per word) and proportion of extended pauses and filled pauses per utterance. Previous reports have promoted number of pauses per utterance as a potential biomarker for anxiety during aphasia discourse (Cahana-Amitay et al., 2011, 2015)

Statistical Analysis

The effects of cognitive and social demands on the psychological stress and communication of people with moderate, mild, and no aphasia while retelling a story were analyzed using ANOVAs, a Kruskal-Wallis Test, and one-sample t-tests.

Psychological stress, story retell performance, tone discrimination accuracy, and tone discrimination response time (RT) were analyzed using two-way mixed effects ANOVAs. The two factors were Group (moderate aphasia, mild aphasia, control) as the between-subject factor and Condition as the within-subject factor. Because data distributions did not meet the assumption of homogeneity of variance, logarithmic transformations were performed on productivity and pause data. Repetition data did not meet the assumptions of normality and homogeneity of variance even after transformation; therefore, these data were analyzed using a Kruskal-Wallis Test. Tukey's HSD or Wilcoxon Rank Sum tests were used to follow up on significant main effects.

The effects of cognitive and social demands were further investigated using a percentage change score. The dual task change score represented the relative change in performance between the supportive partner and dual task conditions for a given dependent variable (i.e., productivity, efficiency, rate, and pauses). This score was calculated by dividing the difference in value between supportive partner and dual task performance by the value of the supportive partner performance, then multiplying by 100 to express as a percentage. The same method was used to calculate the nonsupportive partner change score (i.e., the relative change between supportive and nonsupportive partner communication). We will refer to percent change related to dual task performance as *dual task effects* and percent change related to performance when talking with a nonsupportive partner as *nonsupportive partner effects*. Negative dual task and nonsupportive partner effects indicate that performance deteriorated in the dual task or nonsupportive partner condition (i.e., dual task or nonsupportive partner costs) whereas positive dual task and nonsupportive partner effects indicate that performance improved (dual task or nonsupportive partner benefits). Dual task and nonsupportive partner effects for each group were analyzed using one-sample t-tests to determine whether performance changed significantly in these conditions. Differences in dual task and nonsupportive partner effects between participant groups were also analyzed using one-way ANOVAs with Group as the independent variable. Tukey's HSD was used for post-hoc analyses. In addition, change scores were used to visualize and describe effects of cognitive and social demands on story retell performance for individual participants.

To explore relationships between the effects of cognitive and social demands on communication across all participants, we conducted correlational analyses between dual task and nonsupportive partner effects. Correlations between psychological stress ratings and story retell measures were also analyzed.

All statistical analyses were completed using R 3.4.1 (R Core Team, 2017). Mixed-effects ANOVAs were completed on models built using the lme function within the nlme package (Pinheiro, Bates, Debroy, Sarkar, & R Core Team, 2017) and pairwise comparisons were made on the model using the emmeans package (Lenth, 2017).

Results

The three participant groups differed in story retell for both accuracy (i.e., speech productivity [number of CIUs] and speech efficiency [percent CIUs per word]) and speed (i.e., speech rate [words per minute] and pauses per utterance). Significant group differences were observed for all variables examined and almost all measure and group pairs. In general, performance was poorest on all measures for participants with moderate aphasia. Their stories were less productive, less efficient, told with a slower speech rate, and contained more pauses per utterance than those told by participants with mild and no aphasia; they also produced more repetitions per word than participants with no aphasia. Participants with mild aphasia performed better than the moderate aphasia group but worse than controls. Their stories were more productive and efficient, and told with a faster speech rate and fewer pauses than people with moderate aphasia. There was no difference, however, in the proportion of repetitions produced by these groups ($p = .140$). Participants with mild aphasia also performed significantly worse than the control group across all measures except productivity. Their productivity was only worse than the control group during the dual task condition ($p = .010$).

In addition to the participant group effect, dual task and nonsupportive partner conditions reduced story retell accuracy and speed, but only dual task effects were statistically significant.

Table 3.3. Descriptive Data for Story Retell Performance Among Participant Groups Within Three Experimental Conditions.

		Moderate Aphasia			Mild Aphasia			Control		
		SP	NP	DT	SP	NP	DT	SP	NP	DT
Productivity	*M*	43.50	47.90	29.50	108.82	90.18	72.09	195.00	172.17	180.92
	SD	32.88	36.91	37.44	44.97	35.84	28.18	80.66	42.79	81.74
	Median	36.00	39.00	18.50	106.00	89.00	74.00	169.00	175.50	165.00
	Range	13-122	9-121	4-128	38-207	37-159	37-137	116-426	103-246	122-428
Efficiency	*M*	36.84	37.86	24.38	62.37	62.81	55.15	87.36	88.73	87.71
	SD	18.62	16.54	14.85	19.98	17.19	16.13	8.59	6.65	7.24
	Median	33.28	39.95	26.96	61.63	56.22	58.67	89.05	90.78	89.16
	Range	17.92-72.22	11.80-63.25	2.70-46.90	22.75-95.74	34.26-86.41	27.21-73.15	70.04-97.48	75.61-97.03	64.49-98.17
Rate	*M*	47.92	44.43	38.92	102.16	98.23	76.93	158.52	143.60	137.68
	SD	19.51	19.85	19.99	31.53	38.41	27.15	22.33	21.61	19.17
	Median	56.19	43.95	41.12	110.00	96.26	82.45	156.72	137.43	144.24
	Range	14.09-71.87	19.44-70.36	8.98-65.07	41.30-152.91	42.04-174.08	28.60-122.10	115.97-204.15	121.55-200.79	105.68-157.33
Repetitions	*M*	0.03	0.02	0.03	0.02	0.02	0.01	0.00	0.00	0.01
	SD	0.02	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01
	Median	0.03	0.01	0.02	0.02	0.02	0.01	0.00	0.00	0.01
	Range	.01-.06	.00-.09	.00-.07	.01-.06	.00-.08	.00-.05	.00-.02	.00-.03	.00-.02
Pauses	*M*	2.07	2.18	2.75	0.77	1.18	1.25	0.49	0.65	0.72
	SD	0.75	0.87	1.29	0.33	0.81	0.71	0.37	0.43	0.39
	Median	2.18	2.11	2.83	0.73	0.87	1.25	0.41	0.66	0.70
	Range	.69-2.92	.90-3.75	.73-5.22	.20-1.50	.12-2.71	.42-2.55	.11-1.13	.00-1.5	.09-1.30

Note. SP = Supportive Partner (i.e., communication partner demonstrating supportive nonverbal feedback); NP = Nonsupportive Partner (i.e., communication partner demonstrating nonsupportive nonverbal feedback); DT = Dual Task (i.e., concurrent tone discrimination).

Table 3.3 summarizes descriptive statistics for the five story-retell variables among and within participant groups. For story retell accuracy (i.e., productivity and efficiency) there was an overall reduction for PWA during the dual task condition. Production speed (i.e., rate and pauses) showed an overall reduction for rate and increase for pauses across all groups in both nonsupportive partner and dual task conditions. These changes, however, were only significant in the dual task condition. As shown in Table 3.4, there was also a reduction in tone discrimination accuracy and increase in RT in the dual task condition. Findings will be presented in order of the three study aims: first, we will present results related to the effects of cognitive and social demands on psychological stress; second, results regarding story retell performance in each condition will be presented; finally, we present results from exploratory correlational analyses.

Table 3.4. Means and Standard Deviations for Tone Discrimination Accuracy and Reaction Time in Isolation and while Concurrently Retelling a Story Across Three Groups.

	Isolation		With Discourse	
	Accuracy	RT	Accuracy	RT
Moderate Aphasia	0.88 (.16)	1.11 (.42)	0.61 (.28)	1.28 (.29)
Mild Aphasia	0.92 (.10)	0.87 (.20)	0.68 (.26)	1.32 (.30)
Control	0.99 (.02)	0.82 (.14)	0.90 (.03)	1.45 (.40)

Note. Only accurate button press responses were included in the average reaction time (RT) measures.

Psychological Stress

We hypothesized that both socially and cognitively challenging communication situations would lead participants to report greater psychological stress. Consistent with this hypothesis, analysis of stress ratings showed a main effect for Condition ($F[2, 30] = 13.63$, $p < .001$). Stress ratings were higher in the nonsupportive partner and dual task conditions than in the supportive partner condition ($p < .001$). Figure 3.1 illustrates the average psychological stress rating for each condition across participants with moderate, mild, and no aphasia. This analysis showed no group effect and no interaction effect.

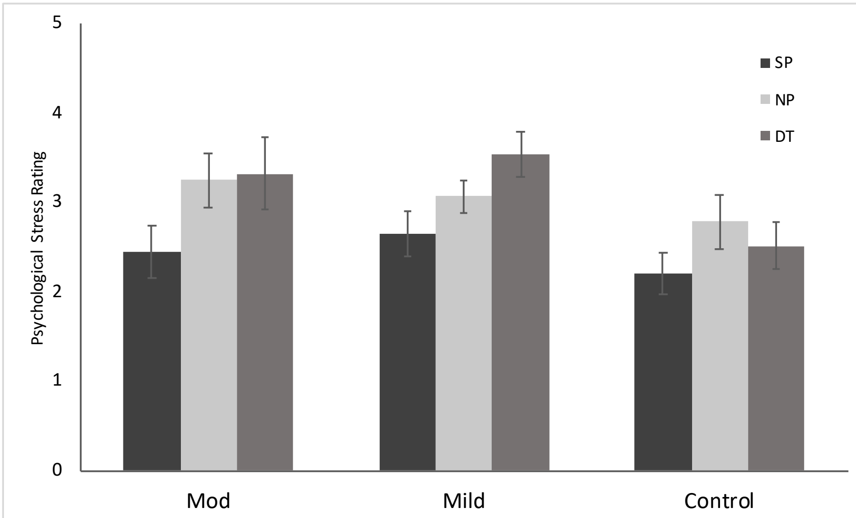

Figure 3.1. Mean psychological stress ratings reported by each group across three conditions. Stress was rated on a 5-point Likert scale with higher scores indicating greater psychological stress. Error Bars indicate standard error. SP = supportive partner condition; NP = nonsupportive partner condition; DT = dual task condition.

Dual Task Effects

All groups were affected by the dual task condition but the effects varied depending on the group and the measure. First, dual task costs were generally greater for PWA than controls (see Figure 3.2). Second, dual task costs on *accuracy* (i.e., productivity, efficiency) were greater for participants with moderate compared with mild aphasia whereas dual task costs on *speed* (i.e., rate, pauses) were greater for participants with mild compared with moderate aphasia. These findings are discussed in more detail below. Dual task costs on the nonlinguistic tone discrimination task followed a similar pattern with greater accuracy reductions for PWA than controls but speed reductions more prominent for the mild than moderate aphasia group. We will first present results related to dual task effects on accuracy followed by results related to dual task effects on speed.

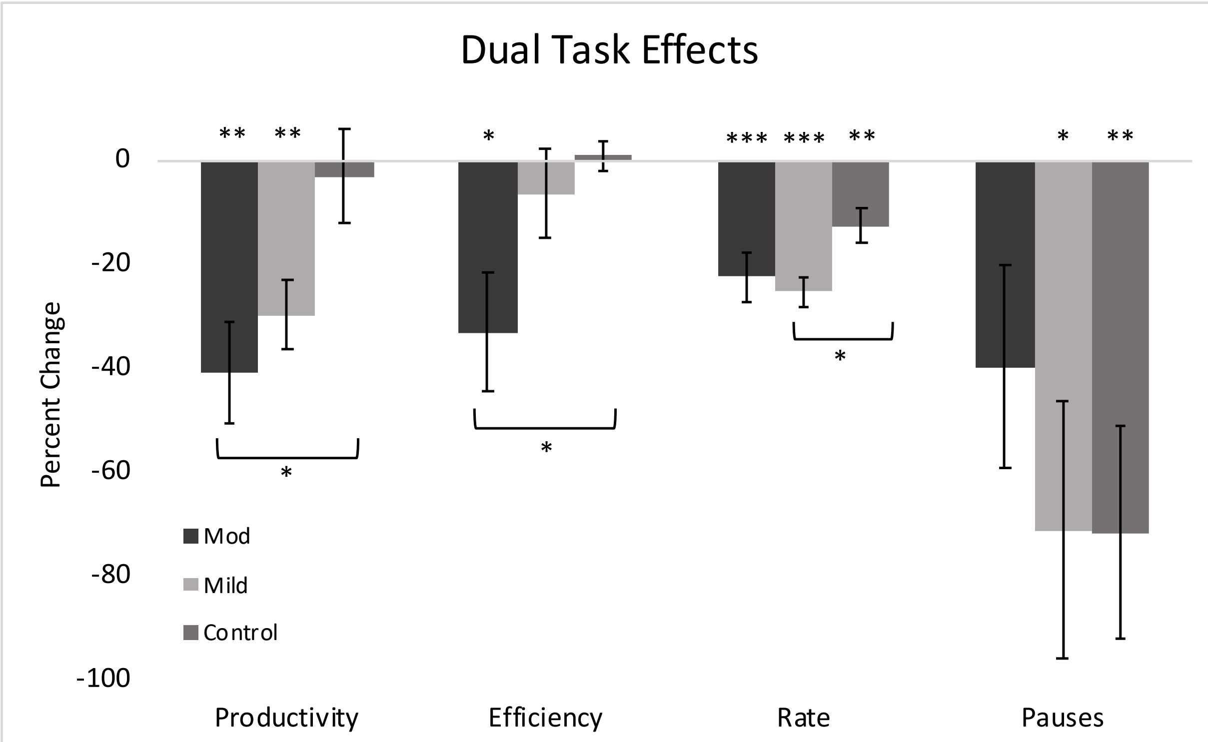

Figure 3.2. Dual task effects on measures of accuracy (productivity and efficiency) and speed (rate and pauses) during story retell production across participant groups. A negative change represents dual task costs. Asterisks above bars show significant dual task costs on that measure for the specified group. Bracketed asterisks show significant differences in dual task costs between the specified groups. Mod = moderate aphasia group; Mild = mild aphasia group; Control = control group. Error bars indicate standard error. *$p < .05$; **$p < .01$; ***$p < .001$.

Accuracy. Measures of accuracy included speech productivity (i.e., number of CIUs), which accounts for the number of accurate words produced (i.e., intelligible in context, relevant, informative) and speech efficiency, which accounts for the percentage of accurate words produced. Tone discrimination accuracy was also measured as the percent with which participants correctly distinguished between two tones. Dual task effects on accuracy differed among participants with moderate, mild, and no aphasia.

Participants with moderate aphasia experienced prominent dual task costs on tone discrimination and story retell accuracy. This group decreased story retell accuracy in terms of both speech productivity ($t[9] = -4.15$, $p = .002$) and efficiency ($t[9] = -2.86$, $p = .019$). The dual task cost on both measures was significantly greater for this group than for participants with no aphasia (productivity, $p = .011$; efficiency, $p = .017$). Similarly, follow up testing after a significant two-way mixed effects ANOVA showed that participants with moderate aphasia had significantly reduced tone discrimination accuracy ($p = .003$) whereas those with no aphasia did not ($p = .642$).

In contrast, participants with mild aphasia experienced less dual task costs on their story retell accuracy. They significantly reduced their speech productivity ($t[10] = -4.44$, $p = .001$) but not their efficiency ($t[10] = -.74$, $p = .474$). Unlike the moderate aphasia group, there was no significant difference in dual task costs on these measures between participants with mild aphasia and the control group (productivity, $p = .079$; efficiency, $p = .059$). Similar to the moderate aphasia group, participants with mild aphasia did show significantly reduced tone discrimination accuracy in the dual task condition ($p = .006$).

The control group showed no dual task effect for story retell accuracy (productivity, $p = .746$; efficiency, $p = .743$). There was also no significant dual task effect on their tone discrimination accuracy ($p = .642$).

Speed. Measures of speed included speech rate (i.e., words per minute) and pauses (i.e., number of extended and filled pauses per utterance). Tone discrimination RT was also considered a measure of speed. Dual task effects on speed differed among participants with moderate, mild, and no aphasia.

Participants with moderate aphasia experienced few dual task effects on speed. During story retell, they reduced their speech rate ($t[9] = -4.84$, $p < .001$) but had no significant change in their pauses per utterance ($t[9] = -2.03$, $p = .073$). Similarly, they experienced no dual task effect on their tone discrimination RT ($p = .618$).

In contrast, participants with mild aphasia and the control group experienced prominent dual task costs on speed during tone discrimination and story retell. Although story retell speed was reduced for both groups, the effect was greater for participants with mild aphasia. Like the control group, participants with mild aphasia experienced dual task costs on their pauses (mild, $p = .0163$; control, $p = .005$) and speech rate (mild, $p < .001$; control, $p = .003$); however dual task costs on rate were significantly greater for the mild aphasia group ($p = .042$). Tone discrimination speed in the dual task condition also decreased for participants with mild aphasia and controls. Both groups increased RT during dual task tone discrimination (mild, $p = .002$; control, $p < .001$).

Nonsupportive Partner Effects

The effect of a nonsupportive communication partner was highly variable across all participant groups. As shown in Figure 3.3, there was a trend towards decreased speed across all groups but, contrary to our hypothesis, none of the effects reached statistical significance. Figure 3.4 illustrates the nonsupportive partner effects for each participant as compared with dual task effects. Negative values indicate a nonsupportive partner or dual task cost; positive values indicate a nonsupportive partner or dual task benefit. In the following, we discuss individual results related to accuracy and speed.

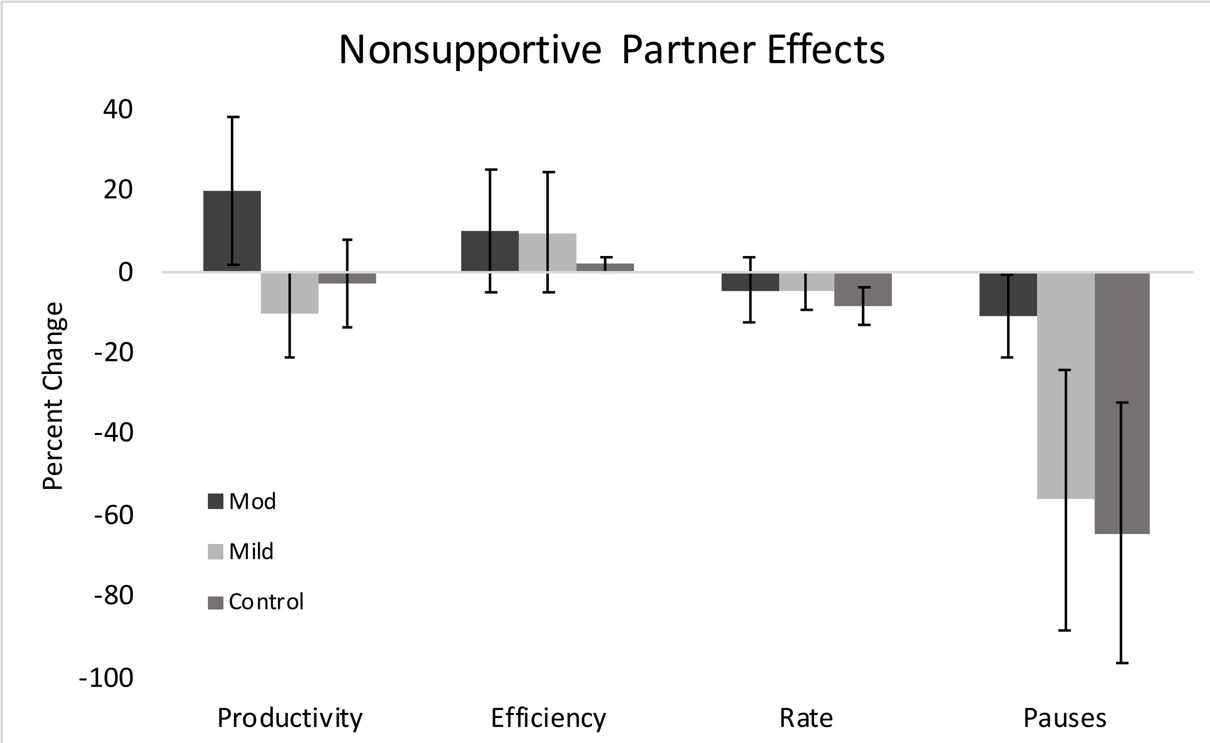

Figure 3.3. Nonsupportive partner effects on measures of accuracy (productivity and efficiency) and speed (rate and pauses) during story retell production across participant groups. A negative change represents dual task costs. Mod = moderate aphasia group; Mild = mild aphasia group; Control = control group. Error bars indicate standard error.

Accuracy. Individual participants across all groups varied in how talking to a nonsupportive partner influenced the accuracy of their story retell. Across all participants with aphasia, 48% (10/21) decreased their speech productivity and 43% (9/21) decreased their speech efficiency when retelling a story to a nonsupportive partner. For the control group, individual nonsupportive partner effects on productivity also varied. Nonsupportive partner effects on efficiency for this group, however, were fairly stable with only one control participant showing a greater than five percent decrease and two showing a greater than five percent increase.

Speed. Generally, participants reduced their speed when retelling a story to a nonsupportive compared with a supportive partner. These effects were more consistent than those related to accuracy but there was still high individual variability. Although the

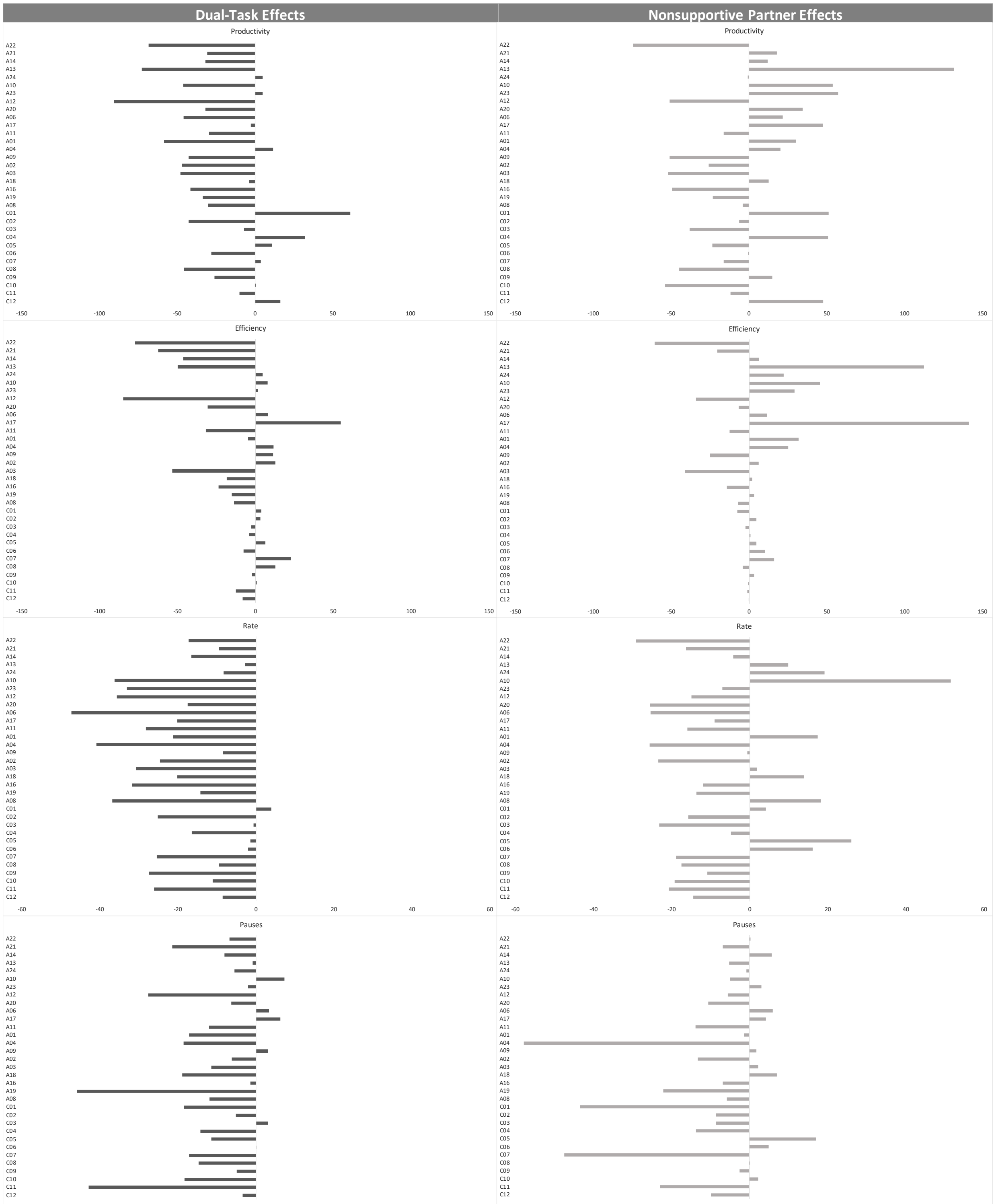

Figure 3.4. Dual task and nonsupportive partner effects for each individual participant. Participants are arranged on the y-axis in order of language severity with most severe on top and control participants on bottom. Bars extending to the left indicate dual task or nonsupportive partner costs. Bars extending to the right indicate dual task or nonsupportive partner benefits.

nonsupportive partner cost on speed was not significant it neared significance for rate in the control group ($t[11] = -1.821$, $p = .096$) and for pauses in the mild aphasia and control groups (mild, $t[10] = -1.73$, $p = .113$; control, $t[11] = -2.01$, $p = .070$). Individual participant data confirmed that talking to a nonsupportive partner had more consistent—but still variable—effects on story retell speed. Two-thirds (14/21) of PWA and three-quarters (9/12) of control participants decreased their speech rate. Similarly, nearly two-thirds (13/21) of PWA and three-quarters (9/12) of control participants increased their pauses per utterance. All participants except A18 and C05 either decreased their speech rate, increased their pauses per utterance, or both.

Exploratory Analysis

Correlation analyses were used to explore the relationships between psychological stress and story retell performance as well as relationships between how social and cognitive demands affect story retell performance. The first correlation analysis examined relationships between dual task and nonsupportive partner effects. Positive correlations showed similarities between dual task and nonsupportive partner effects on psychological stress ($r = .45$, $p = .009$), speech efficiency ($r = .49$, $p = .004$), and pauses per utterance ($r = .40$, $p = .020$). Negative correlations between nonsupportive partner effects on productivity and efficiency and dual task effects on tone discrimination accuracy (productivity, $r = -.44$, $p = .010$; efficiency, $r = -.50$, $p = .003$) showed that greater dual task costs on tone discrimination related to more accurate performance on the story retell task in the nonsupportive partner condition.

The second correlation analysis investigated relationships between psychological stress ratings and the dependent variables used to measure story retell performance. These results are summarized in Table 3.5. Statistically significant negative correlations were found between psychological stress and (a) productivity (r = -.26, p = .010), (b) efficiency (r = -.30, p = .002), and (c) speech rate (r = -.33, p = .001). In other words, as psychological stress increased, participants showed reduced productivity, efficiency, and rate.

Table 3.5. Correlations Between Perceived Stress and All Spoken Language Behaviors.

	Productivity	Efficiency	Rate	Repetitions	Pauses
Perceived Stress	-0.257*	-0.301**	-0.328***	0.057	0.098

Note. * = p < .05; ** = p < .01; *** = p < .001. Productivity = number of correct information units produced during the narrative; Efficiency = proportion of correct information units to words produced during the narrative; Rate = words per minute; Repetitions = repetitions per word; Pauses = number of extended and filled pauses per utterance.

Discussion

Everyday communication often occurs in situations that impose greater cognitive and social demands than controlled clinic environments. The aim of the present study was to understand the effects of cognitive demands (manipulated via a dual task) and social demands (manipulated via a nonsupportive communication partner) on psychological stress and spoken language performance of PWA during a narrative discourse task. Participants reported feeling higher levels of stress when retelling stories in both dual task and nonsupportive partner conditions. Despite this similarity, spoken language was affected differently. In the dual task condition, the moderate and mild aphasia groups exhibited group-specific speed-accuracy trade-off patterns. In the nonsupportive partner condition, speed and accuracy varied among individual participants. While cognitive and social demands had different overall effects, some relationships were noted in how dual task and nonsupportive partner conditions influenced communication.

Speed-Accuracy Trade-offs

The trade-offs between decreased speed and relatively preserved accuracy for the mild aphasia group and decreased accuracy with less impact on speed for the moderate aphasia group suggests greater attention impairments resulting from moderate aphasia. The notion that aphasia severity is associated with attention impairment has been confirmed by previous research. Murray (2012) found that aphasia severity was significantly correlated with all subtests of a standardized measure of attention and caregivers' subjective ratings of behaviors associated with attention deficits. In what follows, we discuss the group-specific trade-off patterns we observed. We begin with controls, followed by the moderate then mild aphasia groups.

Our control group was made up of healthy older adults with no history of stroke. Older adults require greater processing time to perform cognitively demanding tasks accurately (Kemper, Herman, & Lian, 2003; Kemper, McDowd, Pohl, Herman, & Jackson, 2006). In our study, controls were able to buffer dual task costs on accuracy by extending their processing time. This study confirmed previous reports that healthy older adults decrease their speed on both nonlinguistic (Murray, 2000; Murray et al., 1998) and discourse tasks (Kemper et al., 2003; Oomen & Postma, 2001) when faced with increased cognitive demands. In addition, our results suggested that, similar to what has been shown with a nonlinguistic task (Murray, 2000; Murray et al., 1998), healthy older adults reduce their delivery speed in order to maintain accuracy. While their impaired attention made them unable to fully implement this strategy, people with mild aphasia were able to avoid some of the interference to story retell accuracy by greatly reducing their speed.

People with moderate aphasia had the most pronounced dual task costs to accuracy but less costs to speed. This suggests that people with moderate aphasia were unable to strategically reduce their fluency in order to increase their processing time. For this reason, they suffered profound interference in story retell accuracy. It is important to note that the speech rate did decrease yet there was no change in their pauses. In other words, they spoke more slowly but did not produce a greater proportion of extended and filled pauses per utterance. This suggests that they were slowing down but perhaps not pausing at opportune times that allowed them to meet the demands of both tasks.

There are several potential explanations for why the moderate aphasia group might have experienced greater dual task costs to accuracy than speed. First, because the processing demands of the story retell task were already great, this group was less disposed to changes in speed. Even in the supportive partner condition, participants with moderate aphasia were telling stories at a very slow rate (47.92 words per minute) and with many extended and filled pauses (2.07 pauses per utterance). The significant dual task effect on accuracy for the moderate aphasia group might indicate the tendency for attentional demands to interfere more with accuracy for those whose processing of a given task is already slow. In other words, a natural response to increased cognitive demands might be to decrease speed of performance in order to increase processing time. But if processing time is already high or the demands of the task have already reached ceiling, then slowed processing might reflect more on performance accuracy than speed (see also discussion by Laures, 2005). Second, their more severely impaired attention (Murray, 2012) might have prevented people with moderate aphasia from using the executive control processes necessary to pause strategically.

Unlike the moderate aphasia group, participants with mild aphasia seemed able to strategically reduce their story retell speed in order to maintain efficiency in the face of increased cognitive demands. Although they generally performed more poorly than controls in accuracy and speed, they showed a similar speed-accuracy trade-off pattern. The benefit in accuracy required participants with mild aphasia to reduce their speech rate significantly more than controls, demonstrating an overall greater dual task cost. In addition, people with mild aphasia increased their pausing in the dual task condition. It appears that in addition to reducing their speed generally, these participants paused to facilitate strategic attention shifting between the story retell and tone discrimination tasks.

People with mild aphasia seem to have the attentional resources necessary to successfully confront cognitively demanding communication situations, but explicit training would likely prepare them to better meet these demands during everyday communication. For example, therapy for this group might incorporate practice in dual task situations to simulate real-world distractions and facilitate generalization (see e.g., Hinckley & Carr, 2005; Hinckley, Patterson, & Carr, 2001). Given the results of the present study, a suggested approach to such training would be to first emphasize accuracy (allowing the client to decrease speed as necessary) then incrementally helping the client increase speed while maintaining accuracy. Therapy might also integrate explicit instruction and practice pertaining to slowing down when situational demands increase.

The reduction in speed demonstrated by participants with mild aphasia particularly buffered dual task effects on speech efficiency (percent CIUs per word). This differs somewhat from a previous finding related to discourse production by people with mild aphasia during divided attention. Unlike the present study, Murray et al. (1998) found that participants described a picture less efficiently in divided attention conditions compared with a single task condition. They found no difference in efficiency, however, when comparing focused attention (i.e., picture description while hearing but not responding to tones) to divided attention where the participants were instructed to prioritize the picture description task. Given the instructions in the present study (do the best they could at retelling the story while performing the tone discrimination task), participants were also likely to prioritize the story over the tones. The supportive partner condition in our study, however, may have required greater overall processing than the single task condition in the Murray et al. (1998) study because of (a) greater linguistic processing required for story retell over picture description and (b) the need in our study for participants to attend to supportive partner feedback. One indication of this is that the supportive partner condition in our study yielded lower average efficiency (62.37) than the single task condition in the Murray et al. (1998) study (76.31).

Response to Stress Induced by a Nonsupportive Partner

In support of our hypothesis, levels of self-reported stress were greater with a nonsupportive than with a supportive partner, confirming that the former condition was more emotionally demanding. Increased psychological stress with a nonsupportive partner underscores the need to train communities in basic supportive communication techniques (Turner & Whitworth, 2006). In addition, understanding that interactions with nonsupportive communication partners are stressful for PWA highlights the importance of further research investigating emotion-language interlinks and their role in aphasia recovery (see Cahana-Amitay & Albert, 2015 for further discussion on this topic).

Although it increased stress, talking to a nonsupportive partner did not significantly affect story retell performance. This was contrary to our hypothesis and is explained by high individual variability in the data. When comparing individual nonsupportive partner and dual task effects, nonsupportive partner effects were less consistent (see Figure 3.4). For example, all PWA except one reduced their productivity in the dual task condition whereas less than half (10/21) did so in the nonsupportive partner condition. Even for measures of speed, which showed more consistent trends towards interference in the nonsupportive partner condition, results were variable. Speech rate, for example, decreased for two-thirds of PWA (14/21) in the nonsupportive partner condition but decreased for all PWA in the dual task condition. Individual differences in how participants responded to the communication partner or differences in how they responded to and coped with stress might explain some of this variability.

First, individual participants might have responded differently to the nonsupportive communication partner. Some participants seemed attuned to the communication partner behaviors while others seemed indifferent. One indication of this was found in the exploratory analysis, which showed that participants who experienced greater dual task costs on tone discrimination accuracy were more likely to improve their accuracy when talking to a nonsupportive partner. It seems that these participants tended to focus more on the story and worry less about the secondary stimuli—whether this was the listening task or the nonsupportive partner feedback. Implications regarding participants' choices and strategies are further discussed in the following section. A few participants also reported that they wondered if the partner was purposefully nonsupportive for experimental purposes. Although these differences likely contributed to how participants responded in this condition, they are also valuable for understanding the unique ways in which speakers respond to the feedback they receive from a communication partner. Immediately following the experiment, participants completed semi-structured interviews, which were subsequently analyzed qualitatively. Chapter 4 reports findings from this qualitative investigation and provides further insight into participants' subjective responses.

Second, individual participants may have differed in how they responded to and coped with their feelings of stress when talking to a nonsupportive partner. One variable related to stress and performance is arousal. The Yerkes-Dodson law (1908) suggests a link between performance and arousal such that as arousal reaches a mid-point, optimal performance occurs but when arousal is too low or too high, performance deteriorates (see also Cahana-Amitay &

Albert, 2015). It is likely that some participants' stress led to arousal levels consistent with more optimal performance where others experienced hyperactive neurovisceral activity. One previous study found a relationship between physiological stress response and word productivity during a discourse task in aphasia, suggesting that some participants with aphasia persisted throughout the task and spoke more because of increased arousal (Laures-Gore et al., 2010). This same phenomenon may account for the nearly half of participants in the present study who increased their productivity and efficiency when talking with a nonsupportive partner. Additional studies should incorporate physiological measures of stress response to more directly investigate questions related to arousal.

In addition to arousal, individual participant's coping style may have played a role in how stress affected their communication (Laures-Gore & Buchanan, 2015). Even if participants' stress response to the nonsupportive communication partner was similar, some may have been better equipped to cope with their reaction. In a previous study, PWA were shown to possess fewer coping resources than their peers with no aphasia—particularly in their self-awareness and ability to relax and control their thoughts during stressful situations (DuBay, Laures-Gore, Matheny, & Romski, 2011; Laures-Gore, Hamilton, & Matheny, 2007). Such strategies might account for vulnerability or resilience to the effects of stress (Laures-Gore & Buchanan, 2015) and warrant further investigation.

It is important to note here that most PWA in the present study were members of a nonprofit organization that serves people with chronic aphasia through group therapy and community education. They had been explicitly taught strategies for facilitating effective communication in everyday life. Many also proactively sought out opportunities to engage within their communities. For these reasons, the sample of PWA in this study may not be representative of the broader aphasia population—particularly in terms of their response to nonsupportive communication partners. This sample bias likely influenced our findings.

Despite the individual variability in response to stress, measures of speed—particularly pauses per utterance—proved to best capture nonsupportive partner effects. As has been previously proposed by Cahana-Amitay and colleagues (2011, 2015), measures of extended and filled pauses may serve as a behavioral marker of stress in aphasia. Unlike Cahana-Amitay et al. (2015), however, we used a combined rather than separate measures of extended and filled pauses. In their case study, both extended pauses per utterance and filled pauses per utterance increased in the high-anxiety condition yet the magnitude of increase was greater for filled pauses per utterance. Additionally, filled pauses rather than extended pauses have been shown to relate to anxiety induced by self-consciousness about speech (Christenfeld & Creager, 1996). It is possible that including only filled pauses in our measure would have led to a significant effect.

While pauses per utterance were most affected by the nonsupportive partner, other story retell measures were found to relate to psychological stress across all conditions (i.e., speech productivity, speech efficiency, and speech rate). These findings suggest a relationship between feelings of stress and story retell accuracy and speed. Although subjective ratings of stress do not always correlate with physiological measures (Campbell & Ehlert, 2012), it is important to note that the negative correlation between psychological stress and productivity we found is in direct contrast with the positive correlation between physiological stress and productivity found by Laures-Gore et al. (2010). As discussed by Laures-Gore and Buchanan (2015), physiological measures of stress might indicate greater anxiety during a linguistic task (see also Cahana-Amitay et al., 2011) or greater “energy mobilization for better language performance” (p. 697). It is possible that increased physiological stress response signifies greater effort and energy being put forth by the speaker and, therefore, corresponds with increased productivity whereas psychological stress signifies greater anxiety and, therefore, corresponds with decreased productivity. Like psychological stress ratings used previously (see e.g., Hilmert, Christenfeld, & Kulik, 2002; Laures-Gore, Heim, et al., 2007), ours was a basic rating scale intended to understand general emotional reactions to the condition. Future research is needed to disentangle how different stress measures should be interpreted and their behavioral correlates. In Chapter 4 we report qualitative findings, which provide a richer description of participants feelings during the experimental conditions.

Connections Between Attention, Emotion, and Language

While we were unable to directly investigate the link between attention and stress, one aim of the present study was to explore potential relationships between how cognitive and social demands affect communication in aphasia. We hypothesized similarities in these effects due to a shared attentional mechanism. Distraction theories as well as an exposition on the effects of stress in aphasia have posited that regulating one's own emotional reactions can act as a dual task that divides attention from the primary task (Cahana-Amitay et al., 2011; DeCaro, Thomas, Albert, & Beilock, 2011). As has been shown, cognitive and social demands yielded different effects on communication with dual task costs being greater and more consistent than nonsupportive partner costs.

One possibility for the greater overall effects of cognitive demands is that talking to a nonsupportive partner drew upon processes more closely related to focused rather than divided attention. The divided attention task required participants to distinguish between a high and low tone by pushing the appropriate button. The nonsupportive partner condition, on the other hand, did not require participants to give an active response. In a previous study, Murray et al. (1998)

measured the effects of focused attention on picture description accuracy. In the focused attention task, high and low tones were presented to participants but they were not required to respond. The focused attention condition had no significant effect on productivity or efficiency for participants with mild aphasia. While a distracting stimulus (e.g., noise, nonsupportive partner) that doesn't require an active response might still be detrimental to communication, its effects are less likely to be consistent because speakers can choose to ignore it.

Strategies such as choosing to ignore distracting stimuli, slowing down, or pausing strategically might help PWA meet the demands of everyday communication. Before applying them to our therapies, however, we must learn more about these strategies and how to appropriately assess their usefulness. It is likely that choices about strategies and perceptions about their usefulness differ among individual clients (see e.g., Harmon, Hardy, & Haley, 2017). Dynamic assessment might be used to learn what strategies PWA are using in cognitively and socially demanding situations and which of these actually improve their communication. Individualized strategies could then be integrated into their treatment plan.

Despite differences in overall effects, we cannot rule out the possibility of a shared resource allocation mechanism explaining behavioral responses in attentionally and emotionally demanding situations. This possibility was highlighted by correlations between dual task and nonsupportive partner effects on speech efficiency and pauses. Future investigation could more specifically address the interactions between attention and emotion in communication by incorporating a combined dual task and nonsupportive partner condition. Future studies might also incorporate physiological indicators of attention (e.g., pupillometry) in a stressful situation to understand whether the effects of stress on behavior are mediated by attention. Increased understanding of attention, emotion, and language interlinks could lead to therapeutic approaches that better prepare PWA for the demands of everyday communication.

Conclusion

The results of the present study suggest that cognitive and social demands associated with everyday communication lead to feelings of stress for PWA but affect communication differently. Communicating in cognitively demanding situations is particularly challenging for PWA because of impaired attention. Due to greater attentional and linguistic impairment, people with moderate aphasia experience more profoundly decreased accuracy than those with mild aphasia. People with mild aphasia, on the other hand, are able to maintain relative accuracy by decreasing the speed at which they communicate. In light of these findings, therapy for people with mild aphasia might appropriately integrate increased cognitive demands (e.g., via dual tasking) while emphasizing communicative accuracy and incrementally increasing delivery speed.

Communicating in socially demanding situations is stressful for PWA but has variable effects on communication. Some people seem better equipped to meet the emotional demands of communicating with a nonsupportive partner due to their use of strategies or how they respond to feelings of stress. Dynamic assessment of strategies implemented during communication might help therapists tailor their treatments to better meet the demands of everyday communication. Future research should continue to investigate how attention and emotion interact to affect communication in aphasia. Increased understanding of these effects will lead to more ecologically valid assessment and treatments that better generalize to everyday communication.

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CHAPTER 4: SUBJECTIVE RESPONSE OF PEOPLE WITH APHASIA TO NONSUPPORTIVE PARTNERS AND A DUAL TASK

Introduction

People with chronic aphasia are often excluded from social circles and can become isolated. They have been shown to lose friendships, interact with a smaller number of communication partners, and experience general loneliness (see e.g., Parr, 2007). For example, Davidson et al. (2008) found that adults with aphasia communicated with seven times fewer strangers and half as many acquaintances as their peers with no aphasia. One reason for this social isolation is that people with aphasia (PWA) avoid social situations generally (Parr, 2007) and challenging everyday communication situations specifically (Baylor, Burns, Eadie, Britton, & Yorkston, 2011). Even when they do attend events or social gatherings, they have described withdrawing by trying to fade into the background and limit their talking (Baylor et al., 2011, p. 275). Two of the challenges that reportedly lead to the avoidance or withdrawal of PWA from social situations are (a) the attitudes and behaviors of communication partners and (b) background noise (Baylor et al., 2011; Croteau & Le Dorze, 2001; Garcia, Barrette, & Laroche, 2000; Le Dorze, Salois-Bellerose, Alepins, Croteau, & Hallé, 2014). The present study explored the subjective reactions of PWA to these challenges. Insights regarding these reactions will help us better understand what PWA experience and better equip us to introduce therapeutic approaches and strategies that could increase their participation in life.

Communication Partners and Emotion

In addition to fewer friends and smaller social circles, PWA report frequent interactions with partners who are unsupportive of their communication attempts. They perceive these partners to be dismissive, unreceptive, or disengaged and to show signs of annoyance (e.g., sighs, tightening of mouth muscles, shoulder and eye movements; Baylor et al., 2011; Garcia et al., 2000; Skelly, 1975). While communication partners may be nonsupportive because they lack education about aphasia (see e.g., Le Dorze et al., 2014), even those who have some background in speech pathology experience discomfort and impatience when hearing PWA talk (Harmon, Jacks, Haley, & Faldowski, 2016). Dalemans, de Witte, Wade, and van den Heuvel (2010) analyzed qualitative data from daily two-week diary entries and semi-structured interviews completed by 12 PWA and their caregivers. In addition to factors related to knowledge about aphasia, participants revealed that the communication partner's willingness to listen (e.g., by showing patience, talking slowly, and pausing when needed) supported or facilitated their communication. Unfortunately, communication between PWA and nonsupportive partners who were impatient, insensitive, lacked empathy, and failed to really listen was often described.

Only a few studies have reported on how PWA react to their communication partners and these have emphasized the emotional response. Le Dorze et al. (2014) conducted focus group interviews with 19 PWA to learn about their communication in daily life with a specific emphasis on understanding barriers and facilitators. When discussing social factors, participants commented on the lack of support they sometimes received from friends and family members and described feeling "frustrated," "isolated," and "misunderstood" (p. 431). Some participants also described feeling "ridiculed" in public. Feeling left out, ignored, stigmatized, and discouraged during conversations and other communication situations has been described by participants with aphasia in several additional studies (Baylor et al., 2011; Kagan, 1998; Parr, 2001; Skelly, 1975). Beyond these negative emotional reactions that PWA experience toward partners who they perceive as nonsupportive and the barrier that these partners create to social participation, we know very little about how PWA react to and deal with the challenge of communicating with these individuals.

Noise and Attention

In addition to requiring interacting with nonsupportive partners, everyday communication often requires PWA to communicate in situations where there is environmental noise. Qualitative reports have shown that PWA consistently and repeatedly emphasize the challenge of communicating in noisy environments (Baylor et al., 2011; Dalemans et al., 2010; Garcia et al., 2000; Le Dorze et al., 2014; Parr, 2001). They have reported everyday examples of these environments such as living in a city with a lot of background noise (Dalemans et al., 2010, p. 545), "people talking or music and singing in the background" (Baylor et al., 2011, p. 278), and “people talking all at once” (Parr, 2001, p. 276). Most qualitative studies, however, have merely reported that PWA feel that noisy environments complicate and restrict their participation (see e.g., Dalemans et al., 2010; Le Dorze et al., 2014).

How PWA react behaviorally to noise has been demonstrated quantitatively using divided attention tasks and qualitatively via interviews. In two previous studies, Murray and colleagues used a dual task paradigm to investigate the effects of divided attention on the language production of PWA. They showed that naming and describing pictures with a tone discrimination dual task led to greater interference for PWA than for their neurologically healthy peers (Murray, 2000; Murray, Holland, & Beeson, 1998). These findings are inferred to have significance for everyday communication because of the frequent need to do something else while communicating and the distracting influence of environmental noise (e.g., see discussion in Murray et al., 1998). Indeed, qualitative reports have confirmed that PWA recognize noise as a barrier to their communication reporting that they “can’t cope” (Parr, 2001, p. 276) and have difficulty formulating language (Baylor et al., 2011, p. 278). Despite the difficulty that PWA have shown with language production under divided attention and their reports of difficulty communicating in noisy environments, their subjective reactions in response to complex attention tasks involving communication in noise have rarely been addressed. Descriptions of their subjective reactions might better enable us to identify strategies that can help PWA meet the demands posed by these challenging communication situations.

Purpose

In the present study, we explored and categorized the subjective experience of people with and without aphasia immediately following an experiment that specifically manipulated attentional load and communication partner support (see Chapter 3). Previous research has explored the general communicative experiences of PWA qualitatively (Davidson et al., 2008; Parr, 2007) but, to our knowledge, none have explored their subjective response following a structured communication experience that was shared across all participants. We thought that this approach would help us learn about factors that influence everyday communication and how successful communication could be better facilitated in both clinical and everyday environments. The aim of this study was to explore how PWA react in communication situations where they are not supported by their communication partner or have their attention divided by a tone discrimination task. A secondary aim was to uncover differences in the subjective reactions of people with moderate, mild, and no aphasia.

Method

We used a qualitative descriptive research design with data derived from semi-structured interviews. The study was approved by the UNC-CH Institutional Review Board.

Participants

Thirty-three people participated: Twenty-two PWA (13 female; 9 male) and eleven age-matched adults (7 female; 4 male) with no history of stroke. Participants with aphasia had a mean age of 60 years (range = 32-81) and participants with no aphasia had a mean age of 57 years (range = 33-81). All participants with aphasia were at least 19 months post-onset of aphasia (range = 19-220 months) and ranged in severity from moderate to very mild aphasia (Western Aphasia Battery Aphasia Quotient [WAB AQ; Kertesz, 2006] = 52.1-100.0). For analysis purposes, PWA were separated into moderate and mild sub-groups based on a WAB AQ of 80. All participants completed the Personal Report of Communication Apprehension (PRCA-24; McCroskey, 1997). The PRCA-24 is a self-rating scale in which participants are asked to agree or disagree (using a 5-point Likert scale) with statements about their feelings communicating with others in (a) group discussion, (b) meeting, (c) interpersonal conversation, and (d) public speaking situations. Most participants scored within the low or moderate range in communication apprehension; three participants, however, reported high communication apprehension as indicated by a PRCA-24 score above 83 (one with moderate aphasia [A06], one with mild aphasia [A08], and one with no aphasia [C11]). Table 4.1 shows demographic information as well as questionnaire and language test results for each participant.

Procedure

Data Collection. Each participant completed an experimental study immediately prior to their semi-structured interview. These took place on the UNC-CH campus, at a central meeting location for an aphasia program, or (in one instance) in the participant's home. During the experimental study, participants retold three short stories. Immediately prior to retelling each story, participants listened to a recording of a male voice telling the story while also viewing a

Table 4.1. Participant Information.

ID	Sex	Age	Education	Marital Status	Aphasia Severity	PRCA-24	TPO (yy;mm)	WAB	
								AQ	Classification
A01	F	58	20	Widowed	Mild	61	14;00	87.0	Anomic
A02	F	56	14	Married	Mild	59	4;05	90.7	Anomic
A03	F	81	15	Married	Mild	46	5;07	92.7	Anomic
A04	M	33	16	Single	Mild	34	5;11	87.6	Anomic
A06	F	48	17	Married	Moderate	93	18;04	77.8	Transcortical Motor
A08	M	56	16	Married	Mild	94	2;01	100.0	NABW
A09	F	59	16	Married	Mild	71	1;10	89.9	Anomic
A10	F	72	12	Married	Moderate	60	8;00	72.2	Broca
A11	F	65	15	Married	Mild	44	7;07	84.3	Anomic
A12	F	61	16	Divorced	Moderate	48	11;03	74.1	Anomic
A13	F	61	13	Married	Moderate	69	5;04	67.5	Broca
A14	M	61	20	Married	Moderate	56	5;08	67.0	Wernicke’s
A16	M	60	22	Married	Mild	46	4;08	95.4	NABW
A15	M	70	16	Married	Moderate	53	1;11	76.9	Conduction
A17	F	72	18	Divorced	Mild	70	9;09	82.8	Anomic
A18	F	71	16	Married	Mild	66	18;01	94.0	NABW
A19	M	72	18	Married	Mild	73	8;02	97.4	NABW
A20	M	60	18	Married	Moderate	61	8;07	75.0	Anomic
A21	F	32	13	Single	Moderate	43	11;11	63.7	Conduction
A22	F	56	16	Married	Moderate	80	12;09	52.1	Broca
A23	M	64	18	Married	Moderate	57	3;02	72.7	Broca
A24	M	48	19	Married	Moderate	36	1;07	68.2	Broca
C01	F	71	16	Single	No Aphasia	60	NA	NA	NA
C02	M	70	21	Married	No Aphasia	33	NA	NA	NA
C03	F	50	16	Married	No Aphasia	45	NA	NA	NA
C04	F	55	13	Married	No Aphasia	44	NA	NA	NA
C05	F	33	18	Married	No Aphasia	43	NA	NA	NA
C06	F	81	18	Single	No Aphasia	48	NA	NA	NA
C07	F	34	16	Married	No Aphasia	74	NA	NA	NA
C08	F	60	12	Single	No Aphasia	63	NA	NA	NA
C09	M	64	18	Married	No Aphasia	26	NA	NA	NA
C10	M	66	18	Married	No Aphasia	39	NA	NA	NA
C11	M	48	14	Married	No Aphasia	84	NA	NA	NA
C12	M	61	16	Married	No Aphasia	66	NA	NA	NA

Note. Age and Education are reported in years. PRCA-24 = Personal Report of Communication Apprehension (McCroskey, 1997); TPO = time post-onset; WAB = Western Aphasia Battery-Revised (Kertesz, 2006); AQ = Aphasia Quotient.

series of six pictures that went along with the story. Stories were retold across three conditions: to a supportive communication partner, to a nonsupportive communication partner, and to a supportive communication partner while simultaneously performing a tone discrimination dual task. The stories were pseudorandomly assigned across conditions so that each story was told three to seven times in each condition. Order of condition presentation was also pseudorandomly assigned.

Experimental Conditions. During the supportive partner condition, participants told a story to a student who had been trained to demonstrate supportive communication partner behaviors (Kagan, 1998). These behaviors included a brief introduction—made with normal vocal tone, rate, and loudness. For participants with aphasia, the introduction contained a verbal acknowledgement by the partner of the participant's competence. The supportive partner demonstrated good eye contact, positive facial expressions and head nods, an open body posture, and verbal affiliatives (i.e., "mmhm," "ok," "I see," etc.; Kagan et al., 2001; Simmons-Mackie & Kagan, 1999; Turner & Whitworth, 2006).

The behaviors of the nonsupportive communication partner were opposite those demonstrated by the supportive partner. During the introduction, the nonsupportive partner spoke with a patronizing tone, slow rate, and increased loudness. The partner did not verbally acknowledge the participant's competence and when listening to the story demonstrated poor eye contact, a neutral facial expression, and closed body posture. Affiliatives or head nods were not used.

Both supportive and nonsupportive partners entered the room with a mobile phone, which was placed on top of a clipboard. When they sat down they placed the clipboard and phone on the table between them and the communication partner. The nonsupportive partner shifted her attention approximately every 20 seconds. Occasionally, these shifts of attention included checking the time on the phone in front of her. This was done by pressing the home button on the phone screen. The phone was never picked up or moved by either partner. The supportive partner kept the phone in front of her without touching it.

In the final condition, participants performed a tone discrimination dual task while retelling the story. This consisted of high (2000 Hz) and low (500 Hz) tones that were presented randomly. They were instructed to push a blue-colored button when they heard the low tone and a red-colored button when they heard the high tone. The timing of tone presentations was randomized at an average interval of six seconds.

Semi-structured interviews. Immediately following the experiment, the author interviewed each participant one-on-one to explore their story telling experience, understand their subjective reactions to the experimental conditions, and learn about how they perceived their own performance. The interview began by asking about the overall experience retelling the stories and then proceeded to discuss each situation. If not spontaneously mentioned, participants were next asked if there was anything they noticed about the communication partners that did or did not help them while retelling the story. When appropriate, the interviewer also probed additional topics such as participants' stress response, awareness of communication partner behaviors, and self-evaluation of story retell performance (See Appendix 4.A). Consistent with semi-structured interview methodology, the order and wording of questions were not identical during each interview, which allowed some flexibility during the interview process (Britten, 1995; Halcomb & Davidson, 2006). This flexibility allowed questions to be adapted to the individual needs of each participant to promote comfort and enhance disclosure. It also allowed the interviewer to use more simple and direct questions and increased probing for participants with more severe aphasia.

One way in which interviews were modified to meet individual needs was through the use of supported communication strategies to ensure comprehension and verify responses. These strategies were particularly helpful when interviewing participants with moderate aphasia. During the interview, paper and pen were provided to each participant. To support comprehension, the interviewer used simple sentences and gestures and wrote down key words (see Kagan, 1998). When asking participants to self-assess their performance the interviewer sometimes used a combination of verbal questioning and written choices to elicit and verify responses. As shown in Figure 4.1 panel B, this was done by writing down the three conditions and asking participants to choose the condition in which they thought they performed best and worst. Participants with moderate aphasia were also encouraged to use writing to respond when helpful. When used, paper documents were kept and included in the analysis (see Figure 4.1). Previous studies have effectively obtained qualitative interview data using similar supported communication strategies (Harmon, Hardy, & Haley, 2017; Luck & Rose, 2007).

Following the interview, participants were debriefed about the experiment. During the debriefing, the first author revealed that the nonsupportive partner had been trained to demonstrate behaviors that indicated discomfort and disinterest. The purpose of the manipulation was discussed and questions and concerns were resolved. Participants were then given the opportunity to meet and speak with both the supportive and nonsupportive student volunteers.

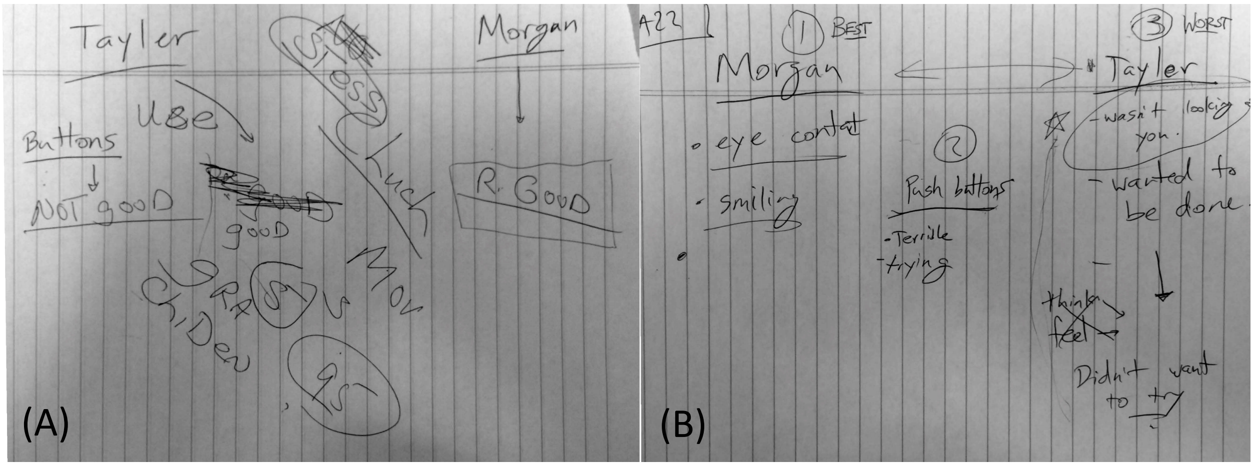

Figure 4.1. Examples of written documents that were used in analysis. Panel A is from the interview with A23. This participant frequently used writing to supplement his verbal communication. Panel B is from the interview with A22. The interviewer used writing with this participant to facilitate comprehension and verify responses.

Analysis

All interviews were transcribed orthographically by an undergraduate research assistant. When the PWA or interviewer used writing, interview transcripts were paired with the corresponding document for analysis. Verbatim transcripts were coded qualitatively in Atlas.ti 8.1.3 using thematic analysis (Braun & Clarke, 2006). Eclectic coding combined structural, descriptive, emotion, and magnitude approaches (Saldaña, 2012). Final themes, subthemes, and categories are outlined in Table 4.2.

The first author and a graduate student research assistant coded the interview transcripts following a five-step iterative process. First, they familiarized themselves with the data by reading through the entire dataset. Second, the first author drafted an initial codebook with descriptive codes that were based on his knowledge of the literature, clinical experience, and purposes of the study (see Appendix 4.B). Third, the author and graduate student used the codebook to code the entire set of interview transcripts. During this process, they worked independently and took notes regarding missing, ambiguous, or uninformative codes. Fourth, the coders met to collaboratively review their coding, discuss discrepancies and refine the codebook. During this phase, it became apparent that subcodes were needed under several of the original codes to describe the data in more detail. Several codes were deleted and combined and many codes were expanded with subcodes. For example, the communication partner behavior code was subcoded to include the different types of behaviors mentioned (i.e., eye contact, phone use, body posture, vocal tone) and the emotional reaction codes were expanded to include emotion subcodes (e.g., frustration, stress, confusion). Fifth, the refined codebook was used to recode the entire set of interview transcripts. This was done by overlaying the new codes and subcodes onto the transcripts that were already marked with the original codes. After recoding, ten discrepancies persisted between the two coders. They were discussed and compared to the codebook definitions to establish consensus about which of the listed codes was most applicable.

After coding was complete, the codes and subcodes were collaboratively organized into preliminary themes by the first author and research assistant. After discussing preliminary themes with a qualitative research methods consultant, the author synthesized preliminary themes in relation to the research questions and aims. This resulted in modified themes, subthemes, and categories, which were then presented to and discussed with the research assistant. During this discussion the author and research assistant deliberated about each theme, subtheme, and category to ensure that they accurately represented the interview data. As a result, six changes were made, which included modifications to the scope of a theme or subtheme and revisions to their labels (see Table 4.2 for final organization). The original code, its abridged codebook definition, and the final subtheme into which the codes were organized are listed in Appendix 4.B. Coded comments included 124 from participants with moderate aphasia, 211 from participants with mild aphasia, and 108 from participants with no aphasia.

Table 4.2. Organizational Structure of Themes, Subthemes, and Categories.

Themes and subthemes	Categories
I. PWA react negatively to nonsupportive partners and a dual task	
A. PWA noticed nonsupportive behaviors and made negative judgments about their partner based on these behaviors	1. "I can't see the eyes" 2. "Looking at her phone" 3. Her introduction was very "sing-song" 4. Poor "body language" 5. "She just wasn't listening" 6. She was "uptight"
B. Participants with no aphasia noticed supportive behaviors and made positive judgments about their partner based on these behaviors	1. "She was smiling" 2. "She was pleasant" and "encouraging"
C. "Is that part of the set up?" – wondering if the partner was intentionally nonsupportive	
D. PWA experience negative emotional reactions to nonsupportive partners and a dual task	1. "I was nervous" 2. It was "frustrating" and "stressful" 3. "I don't want to talk to you" 4. "I don't think it bothered me, I just noticed it"
E. Participants with no aphasia experienced few emotional reactions to nonsupportive partners and a dual task	
II. Nonsupportive partners and a dual task interfere with the communication experience	
A. "That took me off task" - losing concentration with a dual task and nonsupportive partner	
B. "I don't know if that changed anything that I did" – mixed behavioral reactions to nonsupportive partners	
C. Different behavioral reactions to a dual task for participants with and without aphasia	1. "[My story] was interrupted" 2. "I found that I could just tell [the story] and push at the same time"

D. PWA self-assessed their performance differently depending on the story retell condition	1. PWA felt like they did "very good" when telling a story to a supportive partner
	2. PWA gave a mixed self-assessment of a story told to a nonsupportive partner
	3. "I was really bad at that" – PWA self-assessed their performance negatively when telling a story with a dual task
III. Active response to nonsupportive partners and a dual task	
A. PWA made choices about what to prioritize	
B. People with mild aphasia used intentional strategies	1. Focus
	2. Visualization
	3. Moving forward
	4. Big picture
	5. Getting it over with
	6. Rehearsal
	7. Revision
	8. Intentional slowing

Results

Analysis of interview data revealed three themes relating to the experimental conditions and interview questions: first, "PWA react negatively to nonsupportive partners and a dual task," second, "nonsupportive partners and a dual task interfere with the communication experience," and third, "active response to nonsupportive partners and a dual task". Subthemes were nested within each theme with some subthemes being broken down into categories for further description. We will discuss each theme with their related subthemes and categories.

Theme I: PWA React Negatively to Nonsupportive Partners and a Dual Task

Compared to participants with no aphasia, comments from PWA emphasized nonsupportive partner behaviors and reflected negative judgments and emotional reactions in response to these behaviors and a dual task. PWA not only commented more frequently about nonsupportive behaviors, negative judgments, and negative emotions but their comments also reflected stronger overall reactions. For example, even though participants generally commented on feeling more “relaxed” with a supportive partner and “nervous” with a nonsupportive partner, only PWA described becoming angry, frustrated, and “want[ing] someone else to come in here.” When discussing their reactions, participants often contrasted two story retell conditions (e.g., supportive and nonsupportive, supportive and dual task). In doing so PWA were more likely to emphasize the negative experience of the nonsupportive partner or dual task (e.g., “more stressed,” “not as comfortable”) whereas those with no aphasia were more likely to emphasize the positive experience of the supportive partner (e.g., “more engaging,” “more at ease”).

Five subthemes were identified that related to the reactions of people with and without aphasia to nonsupportive partners and a dual task. Subthemes A and B address the communication partner behaviors people with and without aphasia noticed and the subsequent judgments they made about the communication partners. Subtheme C describes that some participants became suspicious because of the nonsupportive partner behaviors. The final two subthemes deal with participants’ emotional reactions.

Subtheme I.A: PWA noticed nonsupportive behaviors and made negative judgments about their partner based on these behaviors. Most comments made by PWA that identified specific behaviors and implied judgments about communication partners who exhibited these behaviors related to the nonsupportive partner. PWA noticed the nonsupportive behaviors demonstrated by this partner and judged the partner as disinterested and uncomfortable because of these behaviors. While the specific behaviors identified by people with moderate and mild aphasia did not vastly differ, behaviors were mentioned by all but four with moderate aphasia (A10, A12, A15, A21) compared to all but one with mild aphasia (A03). The specific nonsupportive behaviors that participants identified were (1) eye contact, (2) phone use, (3) body posture, and (4) vocal tone. Table 4.3 shows the frequency with which each of these behaviors were mentioned.

Table 4.3. Frequency of Communication Partner Behavior Codes

Category	Frequency Count
Eye Contact	39
Phone Use	12
Body Posture	9
Vocal Tone	8

"I can't see the eyes." The nonsupportive partner behavior that was most frequently emphasized by participants was eye contact. Participants from all groups noticed that the nonsupportive partner had poor eye contact but this was emphasized most by participants with aphasia. Some mentioned that the nonsupportive partner looked down and looked around the room; others simply stated, "she did not look at me." Two participants with moderate aphasia (A20, A23) indicated their difficulty with this behavior by expressing during the interview that they wished the nonsupportive partner would demonstrate good eye contact. One said, "the eyes please. I can't see the eyes" and the other pleaded, "bring [the eyes] up."

"Looking at her phone." Descriptions of the nonsupportive partner's interaction with a mobile phone included that she "looked at her phone," "got on her phone," and "played with her phone." Although participants from all groups mentioned these interactions, their comments indicated that this was particularly bothersome for participants with mild aphasia. These participants emphasized this behavior more than any other and were particularly negative in their reaction to it. For example, after mentioning the phone, A02 exclaimed, "that drives me nuts… she was just sitting there with her cell phone and I didn't like that!"

Poor "body language." Three participants with moderate aphasia indicated that they noticed the closed body posture of the nonsupportive partner. A06 mentioned this verbally and A13 and A22 gave this indication gesturally by sitting back in their chair and folding their arms. In addition, four participants commented that the nonsupportive partner seemed restless. They noticed that she "shifted in her seat," "fixed her clothes," and "started like picking at her arm."

Her introduction was "very sing-song." The patronizing voice used by the nonsupportive communication partner during her introduction was described as "sing-song," "robotic," "loud," and "forceful." While people with and without aphasia mentioned this behavior, it was cast more negatively by PWA. As A01 complained, "don't come in the room and talk like she did. It was very sing-song, very slowly."

"She just wasn't listening." In general, PWA described the nonsupportive communication partner as "the girl who did not pay attention," "wasn't listening," "seemed disinterested," and "was not really into it." These judgments were most often discussed in connection with nonsupportive partner behaviors such as poor eye contact and phone use. Several participants also contrasted the two partners. For example, A16 said, "the [nonsupportive partner]… seemed… disinterested; the [supportive] one seemed more interested." Four PWA (1 moderate, 3 mild) suggested that the nonsupportive partner was listening but just didn't act like it. For example, A09 said, "she's listening but she's not there," and A11 stated, "maybe she was listening but she didn't seem like she was."

She was "uptight." Five participants commented on whether or not the communication partner seemed comfortable listening to their story. The nonsupportive partner was described as "introvert[ed]," "nervous," "uptight," and "not at ease in my presence." These descriptions were given by both people with and without aphasia but comments from PWA suggested that their judgments about the partner's discomfort had a direct impact on their reaction. For example, A18 reasoned "when someone's not paying attention, you can't help but not feel comfortable."

Subtheme I.B: Participants with no aphasia noticed supportive behaviors and made positive judgments about their partner based on these behaviors. Comments made by participants with no aphasia emphasized supportive partner behaviors and positive judgments of the communication partner. Although they noticed the nonsupportive behaviors, participants with no aphasia most often focused on describing behaviors demonstrated by the supportive partner. The participants with no aphasia also emphasized positive judgments when talking about the communication partner.

"She was smiling." Participants from all groups noticed and commented that the supportive communication partner smiled, laughed, and gave "encouraging gestures" and "verbal cues" (i.e., 'uh-huh,' 'yeah') but these behaviors were primarily emphasized by participants with no aphasia. In addition to mentioning these behaviors more frequently than those with aphasia, participants with no aphasia explained how smiles, "verbal cues," and "laughing at the little jokey bits" helped them to know that the communication partner "was following along."

Mention of the communication partner smiling and laughing was always connected to the supportive partner with only two exceptions. In these cases, the participants commented on noticing a smile from the nonsupportive partner. In the first instance, A16 explained that he cracked a joke and "she begrudgingly smiled." In the second instance, C06 described telling the nonsupportive partner, "'I don't think you're enjoying the story too much' and she smiled."

"She was pleasant" and "encouraging." Participants described the supportive partner as "friendly," "nice," "pleasant," "kind," "encouraging," and "approachable." When explaining their judgments about the communication partner, participants with no aphasia often contrasted the two partners but did so in a way that highlighted their positive judgments of the supportive partner. For example, C08 explained that "the [supportive partner] seemed to be easier—more approachable. The [nonsupportive partner] seemed to be a little less approachable." C12 said that "the [nonsupportive partner] was very quiet… the [supportive partner] was more engaging." Participants with aphasia also described the supportive partner as "pleasant" and "nice" but most often emphasized their negative judgment of the nonsupportive partner describing her as "stiff," "stern," and "angry."

Subtheme I.C: "Is that part of the set up?" – wondering if the partner was intentionally nonsupportive. Upon recognizing the nonsupportive partner behaviors, 11 participants (1 moderate, 6 mild, 4 no aphasia) indicated that they were suspicious, wondering whether these behaviors were planned and intentional. Six participants (2 mild, 4 no aphasia) commented on this suspicion early in the interview process without any prompting. Most of these comments indicated that the participant recognized that the nonsupportive partner was "doing what [she was] supposed to do." Other participants expressed a similar suspicion but did so only after being prompted to share what they noticed about the communication partners. These participants all had aphasia (4 mild, 1 moderate) and indicated less certainty in expressing their suspicions. For example, A09 suggested that the disinterest shown by the nonsupportive partner was "probably… part of the job" and A02 said, "I don't know if you said that or she's like that. I think it's more like you… told [her] to do it."

Subtheme I.D: PWA experience negative emotional reactions to nonsupportive partners and a dual task. The vast majority of comments made by PWA regarding their emotional response when retelling a story to a nonsupportive partner or with a dual task highlighted a negative emotional reaction. While the stated reactions were most often negative (e.g., nervousness, frustration, stress, anger, confusion), some PWA also expressed ambivalence about how they felt when retelling a story to a nonsupportive partner. Two participants with mild aphasia (A02, A11) explicitly stated that they did not feel any different retelling the story to a nonsupportive partner. Another participant with mild aphasia explained that he had no emotional reaction to the dual task because "I can't think about a story and pressing buttons and then thinking about how I'm feeling about it."

Participants with mild aphasia commented on more and stronger emotional reactions than those with moderate aphasia. For example, participants with moderate aphasia more often distinguished only slightly between the two partners (e.g., nervous with both but more nervous with the nonsupportive partner). They also did not mention some of the stronger emotional responses (e.g., anger and stress) but did comment on less intense emotions that were not mentioned by participants with mild aphasia (e.g., confusion).

It was "frustrating" and "stressful." PWA experienced feelings of frustration and stress when retelling a story to a nonsupportive partner and with a dual task. Feelings of frustration were expressed by four participants with moderate aphasia in relation to the nonsupportive communication partner. These feelings were often connected with the poor eye contact that the nonsupportive partner demonstrated. When asked in the interview how she felt when retelling the story to the nonsupportive partner, A10 showed signs of frustration. Four PWA (2 moderate, 2 mild) described reacting to the dual task with frustration. A12 explained that she became "really, really frustrated." Upon recalling their experience, two PWA threw their hands up in frustration when talking about the difficulty they had. A13 imitated trying to press the buttons while expressing her frustration.

Three participants with mild aphasia also described telling a story to a nonsupportive partner and with a dual task as “really stressful.” These participants often described feeling “more stressed” when talking to the nonsupportive partner or with a dual task than when talking to the supportive partner. A17 repeatedly mentioned the stress she felt when talking to the nonsupportive partner and A19 commented twice on feeling “more stress” with the dual task.

“I was nervous.” PWA described themselves as feeling uncomfortable, particularly when talking to the nonsupportive partner. Discomfort was expressed through comments about nervousness, wanting someone else to talk to, and not being able to “read” the nonsupportive partner. When talking to the nonsupportive compared with the supportive partner participants described feeling “not as comfortable” and less “at ease.” Although two participants with moderate aphasia (A13, A21) described feeling nervous with both communication partners, they expressed feeling more comfortable with the supportive partner. A03 felt more nervous with the nonsupportive partner but did not attribute it to the partner’s behaviors.

“I don’t want to talk to you.” When retelling a story to a nonsupportive partner or with a dual task, some PWA became angry, irritated, or lost their desire to do well and keep trying. Two participants with mild aphasia expressed sentiments of anger in response to the nonsupportive partner. When asked how talking to the nonsupportive partner made her feel, for example, A02 responded, “pretty messed up. Mad!” A09 said that she was “not happy.” The dual task was also described as “irritable.”

Two PWA (1 moderate, 1 mild) mentioned the communication partner’s influence on their motivation (i.e., their desire to do well and keep trying). For example, A22 expressed wanting to just quit when telling a story to the nonsupportive partner. Similarly, three participants with mild aphasia indicated that the dual task reduced their confidence that they could retell the story successfully.

"I don't think it bothered me, I just noticed it." Seven PWA (3 moderate, 4 mild) described noticing the nonsupportive behaviors but having mixed or uncertain emotional reactions. For example, when talking about the nonsupportive partner's lack of interest, A04 said, "that was fine except I'm here telling a story and she's like doing stuff." Referring to the nonsupportive partner's poor eye contact, A19 said, "I don't think it bothered me, … I just noticed it." Two participants with moderate aphasia (A20 and A15) were confused about the nonsupportive behaviors. A15 wondered if her lack of support was because he was saying the wrong thing or because she just wasn't "very excited about [listening to the story]." One participant with mild aphasia (A18) also expressed mixed feelings in response to the dual task. Although she described the task as "hard," she indicated that she was able to remain calm because she knew she "was not going to lose anything by making a mistake."

Subtheme I.E: Participants with no aphasia experienced few emotional reactions to nonsupportive partners and a dual task. As noted previously, the majority of comments about emotional reactions were made by PWA. Although participants with no aphasia rarely mentioned their emotional response, when they did their comments most often described positive emotional reactions to the supportive partner (e.g., feeling at ease, enjoying telling the story) rather than negative reactions to the nonsupportive partner or dual task. For example, participants with no aphasia described retelling a story to a supportive partner as "pleasant," and "enjoyable." C04 described feeling "comfortable," and C12 felt "at ease."

Theme II: Nonsupportive Partners and a Dual Task Interfere with the Communication Experience

Participants from all groups indicated that retelling a story to a nonsupportive partner or with a dual task interfered with their communication experience. They described a loss of concentration and self-assessed their performance differently in each condition. Even though they described both nonsupportive partners and a dual task as interfering with their experience, participants were split on whether or not their actual performance and communication behaviors were affected by the nonsupportive partner. In addition, PWA described the dual task as affecting their communication behaviors negatively, whereas participants with no aphasia did not.

Four subthemes were identified relating to how participants described the effect of nonsupportive partners and a dual task on their communication. Subtheme A addressed the loss of concentration that participants described. Subthemes B and C relate to behavioral reactions. Subtheme D describes how PWA self-assessed their performance with each category describing a different condition (i.e., supportive partner, nonsupportive partner, and dual task).

Subtheme II.A: "That took me off task" - losing concentration with a dual task and nonsupportive partner. Participants with moderate, mild, and no aphasia described the dual task and nonsupportive partner in terms of how it affected their concentration. Comments about the dual task's interference with concentration were most frequent. Participants from all groups reported that it was hard to focus on both the story retell and tone discrimination tasks and indicated that they had to focus all their energy on the tasks. Some participants described having to alternate their attention between tasks. For example, A18 reported, "I knew I couldn't talk and press buttons at the same time so I stopped to talk and I know I stopped and then I pressed the buttons and then I would go back." Only one comment went against this general trend when C05 stated, "[the dual task] didn't feel that distracting."

Two participants with mild aphasia and one with no aphasia suggested that talking to the nonsupportive communication partner had a distracting influence on their story retell. For example, A16 stated that because of the communication partner's behaviors he was "almost taken off task." C11 suggested similarities in how the dual task and nonsupportive partner influenced attention: "having someone not interested… it was like you almost had that pressure of, 'Okay, well why aren't they engaged? … Is my storytelling not going okay?' It actually kinda' made me concentrate on what she was doing a little bit, almost like the button thing."

Subtheme II.B: "I don't know if that changed anything that I did" – mixed behavioral reactions to nonsupportive partners. Behavioral reactions to the communication partners varied among participants. Some participants described specific behavioral reactions; others had mixed feelings about how they reacted behaviorally; still others indicated that they had no reaction.

Nine PWA (6 moderate, 3 mild) and five participants with no aphasia indicated some behavioral reaction to the communication partner. In general, they described talking to the nonsupportive partner as "harder" and the supportive partner as "easier." They mentioned specific ways that the nonsupportive and supportive partners influenced their communicative behavior. Several participants suggested that telling the story to a nonsupportive partner caused them to talk less and leave information out. Some participants described rushing through the story while others described reacting by having to "stop and restart again." One control participant described being more animated with the nonsupportive partner in an attempt to "engage her more." Two participants reported reacting by closing their eyes while retelling the story. A10 said that she closed her eyes when retelling the story to both partners but A03 reported only closing her eyes when retelling the story to the nonsupportive partner.

Approximately one-quarter of participants (2 moderate, 4 mild, 3 no aphasia) had mixed feelings regarding their behavioral reaction to the communication partner. When referring to the nonsupportive partner's impact on their story retell, two participants with mild aphasia (A02, A08) began to indicate that they had performed worse but before making a conclusive statement, self-interrupted and resolved that they had actually performed "about the same," or "close to normal." The other participants stated that they recognized the nonsupportive communication partner behaviors but didn't feel that it changed how they retold the story. When asked whether they thought the nonsupportive partner affected their story retell, three of these participants responded "no."

Subtheme II.C: Different behavioral reactions to a dual task for participants with and without aphasia. Participants with and without aphasia described different behavioral reactions to a dual task. Participants with aphasia perceived the dual task as having a negative effect on their communication behavior whereas participants with no aphasia perceived a minimal effect.

"[My story] was interrupted." Nine PWA (3 moderate, 6 mild) mentioned a negative behavioral reaction to the dual task condition. They felt unable to do both tasks simultaneously and mentioned "mess[ing] up" on the story, the tone discrimination task, or both. For example, they described their story retell as "interrupted," "cryptic," and prolonged and their tone discrimination as "wrong" and inaccurate.

"I found that I could just tell [the story] and push at the same time." Behavioral reactions to retelling a story with a dual task were rarely mentioned by participants with no aphasia. The three participants who did mention behavioral reactions indicated that they were minimal. C03 said that, prior to the story retell, she was concerned that the dual task might affect her performance negatively, "but then I found I could just tell and push at the same time… I just kind of incorporated it into the story." C09 did not feel like his performance was affected by the dual task but mentioned recognizing that it might be "annoying" for the communication partner. Only one participant with no aphasia (C07) described any negative behavioral reaction by stating that she felt like her retell with a dual task was less "smooth."

Subtheme II.D: PWA self-assessed their performance differently depending on the story retell condition. Participants with aphasia provided different self-assessments of their story retell performance when talking to a supportive partner, nonsupportive partner, and with a dual task. They provided a positive self-assessment of their performance when talking to a supportive partner, a mixed assessment when talking to a nonsupportive partner, and a negative assessment when talking with a dual task.

PWA felt like they did "very good" when telling a story to a supportive partner. Although they admitted that they did not retell the story perfectly, PWA felt like they did "very good" when talking to a supportive communication partner regardless of their severity. Often, these comments were made in relation to the other two conditions to indicate that the participant thought they did "better" or "best" relative to the other conditions. While participants generally assessed their story retell positively when talking to a supportive partner, four PWA (2 moderate, 2 mild) gave a mixed report stating that they did well except for one aspect of the retell which they forgot or had trouble expressing. A10 was the only participant with aphasia who gave a negative self-assessment.

Only two participants with no aphasia provided a self-assessment of their story retell performance when talking to a supportive partner. C10 stated that his story retell “wasn’t bad." C04, on the other hand, stated that she had “less success,” but attributed this to forgetting some of the specific details of that particular story rather than the communication partner.

PWA gave a mixed self-assessment of a story told to a nonsupportive partner. Participants were split on their self-assessment for the story retold to a nonsupportive communication partner. Five PWA (3 moderate, 2 mild) assessed their performance negatively. These participants described their performance as “bad,” “horrible,” “hardest,” and “worst.” They said that they “left a lot of things out” and “didn’t [say] as much.” Six PWA (4 moderate, 2 mild) provided a positive self-assessment of the story they retold to a nonsupportive partner. They described their performance as “good,” “easy,” and “fine." Two participants (A06, C04) specified that they thought they performed better in this condition compared with the supportive partner condition. When asked to verify this response and recognizing the nonsupportive partner behaviors, A06 confirmed, “better. Weird.”

One participant with moderate and two with mild aphasia gave a mixed assessment of their performance when talking to a nonsupportive partner. The two participants with mild aphasia were “not sure” how well they did at retelling the story. The participant with moderate aphasia said he felt like he did well but “couldn’t [say the] words.”

"I was really bad at that" – PWA self-assessed their performance negatively when telling a story with a dual task. Most PWA gave a negative assessment of their performance when retelling a story with a dual task, whereas most participants with no aphasia provided a positive self-assessment. Ten PWA (5 moderate, 5 mild) described their performance as "bad," "worse," "hard," "lousy," and "awful." A08 expressed the overall sentiment that represents comments from this group, "I was really bad at that… it was awful!"

Only one participant with aphasia (A21, moderate) described her story retell performance with a dual task as "good." Conversely, all control participant comments indicated a positive assessment of their performance on the story that was told with a dual task. These participants stated that they did "pretty good." C04 stated, "I did well… I felt successful with that and I was very surprised."

Theme III: Active Response to Nonsupportive Partners and a Dual Task

Participants with aphasia described different ways in which they actively responded to the increased demands posed by a nonsupportive partner or dual task. These active responses included choices about what to prioritize while retelling the story as well as strategies that they chose to employ to aid in their story retell. The majority of these comments were made by participants with mild aphasia.

Subtheme A describes prioritization choices that PWA made when retelling stories to a nonsupportive partner and with a dual task. Subtheme B delineates the strategies that were mentioned by participants—particularly those with mild aphasia. Categories within this subtheme organize the specific types of strategies that were mentioned.

Subtheme III.A: PWA made choices about what to prioritize. Eight participants with aphasia explicitly commented on attending to one task more than another during the experiment. These comments included those indicating whether they prioritized the story retell or tone discrimination in the dual task condition or whether they were focused on the story more than the communication partner behaviors.

Participants with both moderate and mild aphasia made different prioritization choices when retelling the story with a dual task suggesting that what they prioritized was not a function of aphasia severity. Three PWA (A06, A14, A16) commented that they focused more on the "buttons." Two other participants (A15, A19) commented that they concentrated more on the story with less regard for the tone discrimination task.

Only participants with mild aphasia (A17, A18, and A19) mentioned focusing more on retelling the story than the communication partner behaviors. A18 indicated that she looked straight ahead without looking specifically at the communication partner. Similarly, A17 said she tried to ignore what the communication partner was doing and focus on the story. The sentiment of all three participants was captured well by A19 who commented, "I was really focused on the story… I don't think it would have mattered who was sitting there."

Subtheme III.B: People with mild aphasia used intentional strategies. Participants identified a number of strategies that they implemented to help them perform the story retell task. Mostly, comments about strategies were made by participants with mild aphasia. In fact, all participants with mild aphasia mentioned at least one intentional strategy whereas strategies were only mentioned by two participants with moderate and four with no aphasia. The strategies included (1) focus, (2) visualization, (3) moving forward, (4) big picture, (5) getting it over with,

(6) rehearsal, (7) revision, and (8) intentional slowing. The frequency with which each strategy was mentioned is shown in Table 4.4.

When asked, five PWA (3 moderate, 2 mild) explicitly stated that they did not use any strategies. Upon further probing, however, the two participants with mild aphasia went on to describe at least one strategy. Six additional participants with moderate aphasia did not identify a single strategy.

Visualization. Six participants (1 moderate, 3 mild, 2 no aphasia) identified the strategy of visualizing the pictures to aid their retell. The three participants with mild and two with no aphasia described this by explaining how they imagined the picture stimuli to help them retell the story. A06 used visualization in a different way. She described imagining a personal experience that connected with the story.

Focus. One strategy that participants mentioned was focusing on the story. This took two different forms: focusing while telling the story and focusing while listening to the story that they would later retell. Participants with mild aphasia talked about "concentrat[ing] on getting the story out." Two of these participants also mentioned forcing themselves to focus on the story by filtering out distractions. The form of focus that was discussed by the other two participants (A21, C03) involved concentrating while listening to the story that they would later retell.

Moving Forward. Three participants with mild aphasia discussed "moving forward" as a strategy. Most often this strategy was identified in relation to moving on with retelling the story regardless of mistakes. In one instance, A04 said, "once I started, [the story] would come easier" and then talked about keeping the story moving forward.

Big Picture. Five participants (4 mild, 1 no aphasia) described a strategy that involved focusing on the main points or basic structure of the story without getting caught up in the small details. Three of these participants (including the one with no aphasia) explained that this helped ensure that they included the most important parts first. For example, A18 suggested that focusing on the main points of the story allowed her to then “go back and fill in detail.”

Getting it over with. Three participants (1 moderate, 2 mild) described the strategy of getting through the story as quickly as possible. The two with mild aphasia (A01, A08) described using this strategy to avoid forgetting details. The participant with moderate aphasia (A06) explained that she used this strategy when talking to the nonsupportive partner so that she could “get it done” quickly.

Rehearsal, revision, and intentional slowing. One participant with mild and one with no aphasia (A19, C12) described rehearsing specific story details—particularly names—before retelling. A11 discussed going back to correct mistakes or revisit details she forgot as one strategy she used when talking to the nonsupportive partner. A18 described intentionally slowing down and pausing when retelling the story in the dual task condition so that she could press “the buttons and then… go back” to telling the story.

Table 4.4. Frequency Counts for Strategy Subcodes Across Participant Groups

Subcode	Category	Control	Mild Aphasia	Moderate Aphasia
Intentional Strategies				
	Visualization	2	5	1
	Focus	1	5	1
	Moving forward	-	7	-
	Big picture	1	4	-
	Getting it over with	-	2	2
	Rehearsal	1	1	-
	Revision	-	1	-
	Intentional slowing	-	1	-

Discussion

To understand how PWA respond to challenges associated with everyday communication, we explored their subjective reactions when retelling a story to a nonsupportive student and while simultaneously performing a tone discrimination task. In general, PWA were particularly attuned to nonsupportive partner behaviors. They experienced strong emotional reactions to nonsupportive partner and dual task conditions. These conditions also affected how PWA perceived their own communicative performance. The mild aphasia group seemed better equipped to actively respond to the demands of retelling a story to a nonsupportive partner or with a dual task by prioritizing the story and employing intentional strategies.

Heightened Emotional Reactions in Aphasia

In the present study, emotional reactions of PWA seemed to be influenced by the attention they gave to nonsupportive partner behaviors. Their emphasis of these behaviors juxtaposed the mostly positive reactions of participants with no aphasia. Repeated studies have found that older adults pay more attention to and better remember positive over negative information because of the value they place on emotional satisfaction (see Reed, Chan, & Mikels, 2014 for a meta-analysis). In contrast, a bias towards negative information can indicate risk for depression and anxiety (Watters & Williams, 2011; Williams et al., 2009). The bias toward negative stimuli shown by participants with aphasia highlights the need to further understand relationships between aphasia and mood disorders. The negativity bias might indicate early signs of depression or anxiety in aphasia or at least make them particularly vulnerable to negative emotions associated with stress.

While physiological stress response does not always correlate with measures of perceived stress, subjective reports are important for understanding the experience of stress in aphasia

(Laures-Gore & Buchanan, 2015; Laures-Gore, Heim, & Hsu, 2007). The negative feelings reported by PWA in this study likely related to their perceived stress response. The "linguistic anxiety" theory of aphasia posits that mere language use induces stress for PWA due to the threat of linguistic breakdown and, ultimately, communicative failure (Cahana-Amitay et al., 2011). Because we did not ask participants about their feelings when performing a nonlinguistic task, we cannot speculate about the role of language in inducing stress. Our findings do, however, suggest that situational demands might influence the visceral response of PWA more than those with no aphasia. Perhaps this is because the threat of linguistic breakdown is greater in these situations. The consistent pattern of a heightened visceral response from PWA for both nonsupportive and dual task conditions suggests similarities in how the demands associated with these two situations affect stress.

In addition to the presence of aphasia, severity seemed to affect emotional reactions. Several explanations might account for this difference. One possibility is that a greater awareness of deficits caused people with mild aphasia to be more threatened by the demands of the nonsupportive partner and dual task conditions. Recent findings show a relationship between aphasia severity and sound error awareness during word production, suggesting increased awareness for those with more mild compared with more moderate impairment (Mauszycki, Bailey, & Wambaugh, 2017). Further research is required, however, to understand whether this pattern of error awareness extends to social communication. A second possibility is that participants with moderate aphasia were either more habituated to nonsupportive partner feedback or more focused on the communication task, which caused them to attend less to nonsupportive behaviors. Based on the data from this study, participants with moderate aphasia did mention nonsupportive behaviors less than those with mild aphasia. In fact, of the five PWA who did not mention nonsupportive behaviors, only one was from the mild aphasia group.

Although some participants thought they communicated poorly and others thought they communicated well when talking to a nonsupportive partner, the strongest indicator of their assessment seemed to be their perceived emotional response. Only one of the seven participants who felt good about their performance with the nonsupportive partner reported any emotional reaction even though all except two (A03, A12) mentioned nonsupportive behaviors. One way in which three participants with mild aphasia prevented strong emotional reactions was to conscientiously ignore nonsupportive partner behaviors. These three participants also perceived their performance positively in the nonsupportive partner condition.

While some PWA perceived their performance positively in the nonsupportive partner condition, many participants with mild aphasia also reported uncertainty about their performance. Even if they did perform well, it is likely that negative partner feedback led them to be less confident in their successful performance, leading to decreased self-efficacy (Bandura, 1997). This finding implies that even if nonsupportive partner feedback does not directly hinder communicative performance, it might make PWA feel uncertain about their communication, which may be particularly detrimental over time. Previous studies suggest that it is often the perception of PWA about the situation rather than their actual performance that leads them to avoid or withdraw from participation (Dalemans et al., 2010; Le Dorze et al., 2014). To increase social participation, therefore, clinicians should not only assess spoken language but also perceptions about communication. This could be done using self-efficacy ratings (Bandura, 2006) or goal attainment scaling (Malec, Smigielski, & DePompolo, 1991).

Strategies for Improved Everyday Communication

The vast majority of comments about intentional strategies came from participants with mild aphasia. Interestingly, even when strategies shared a subcategorization, those identified by each group were often different in nature (e.g., concentrating while retelling vs. concentrating while listening; visualizing the pictures vs. visualizing a personal experience). Only two participants with moderate aphasia commented on strategies. Given the linguistic demands of the story retell task combined with increased emotional and cognitive demands in the nonsupportive and dual task conditions, perhaps participants with moderate aphasia did not discuss strategies because of more limited attentional resources (see Murray, 2012). If this was the case, the question remains as to whether explicit training of strategies could help people with moderate aphasia improve their performance in demanding communication situations. Because in this study most strategies were identified by people with mild aphasia, we will focus our discussion on this group.

Aside from strategies related to the experimental procedures (i.e., "focus" and "visualization"), those commented on most dealt with not getting hung up on mistakes or details (i.e., "moving forward," "big picture," "getting it over with"). It seems that people with mild aphasia are aware that overemphasizing errors or details can detract from the overall message of their story—especially when they are faced with increased emotional or attentional demands. Other strategies (i.e., "rehearsal," "revision," "intentional slowing") were only mentioned once. People with mild aphasia may comment more on the former strategies when demands are great for multiples reasons: they are more useful, they do not require explicit training, or they require fewer attentional resources. In the present study, each strategy mentioned was deemed useful by participants. Future research, therefore, should determine whether approaches that train PWA to relay a message without getting derailed by linguistic and phonetic errors (e.g., script training [Cherney, Halper, Holland, & Cole, 2008]; integral stimulation [Fridriksson, Basilakos, Hickok, Bonilha, & Rorden, 2015; Wambaugh, West, & Doyle, 1998]) are employed more naturally and with less attentional resources than those that emphasize fixing impaired behavior in the context of discourse (see e.g., Boyle, 2011; Murray, Timberlake, & Eberle, 2007). This understanding would help tailor therapies to strategies that may better improve everyday communication. In addition, because people with mild aphasia are able to pinpoint strategies that help them communicate in challenging situations, therapists might appropriately rely on client perspectives when selecting treatment targets and procedures for this group.

Limitations

Unlike previous studies that have explored how PWA respond to everyday communicative demands while participating in life roles (Baylor et al., 2011) or in the workplace (Garcia et al., 2000), we interviewed participants immediately following emotionally and attentionally demanding communication situations that were manipulated experimentally. While this provided an opportunity for them to reflect on the same recent experience, there were also challenges posed by this approach.

First, because the nonsupportive and dual task conditions relied on experimental manipulations, they lacked the ecological validity of a genuine experience from the participants' everyday life. This was evident in comments from participants who wondered if the lack of support from nonsupportive partners was intentional. Findings, therefore, should be generalized with caution. Genuine experiences from participants' everyday lives, however, may have led to similar but stronger reactions—particularly in response to nonsupportive partners. This was highlighted by A02 who commented that she would have reacted even more strongly if she hadn't been participating in an experiment. The gender and age of the students who acted as communication partners may have also had an effect on participant reactions. Using older adults as communication partners would more closely resemble everyday communication for these participants.

Second, the first author filling the role of investigator and interviewer may have biased some of the responses given by participants. One example of how this was manifest was through some of the participants being hesitant to speak negatively about the nonsupportive partner. Because the first author was in a position of power with the students, who were acting as communication partners, participants may have feared that they were putting the "nonsupportive" student at risk by openly sharing their observations.

Promoting Social Participation

Emotions have an important role in promoting social participation in aphasia that clinicians should recognize and draw upon in assessment and treatment. Given the emotional response caused by demands associated with everyday communication, PWA should be given more opportunities to express their emotions. For example, therapists and caregivers might talk to PWA about emotions relating to specific communication activities and situations. Visual analogue ratings are one tool that could be useful in facilitating such exchanges (see e.g., Haley, Womack, Harmon, & Williams, 2015; Kontou, Thomas, & Lincoln, 2012). When appropriate, treatment techniques could also be used to help PWA regulate heightened emotional responses. For example, PWA may benefit from techniques that train them to better monitor stress and control tension (DuBay, Laures-Gore, Matheny, & Romski, 2011) such as mindfulness meditation (Dickinson, Friary, & McCann, 2017; Marshall, Laures-Gore, & Love, 2018). Future research should uncover how to best integrate emotion and emotion regulation into assessment and treatment in aphasia.

Findings from the present study suggest that everyday communication situations are not only linguistically and cognitively demanding but also emotionally taxing. The emotional response that PWA experience colors their perceptions of how well they communicate. In addition to talking to PWA about their emotions, clinicians should allow PWA to assess their own performance. In doing so they could ask PWA about strategies they find useful. Because negative emotions can impact the communication experience, buffering these reactions might be an appropriate target of therapy. Helping PWA associate more positive emotions and perceptions with their communication experiences could reduce social isolation and improve recovery over time.

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APPENDIX 3.A: CONDITION PRESENTATION GUIDE

Pre-experimental Instructions

[Participant is brought to the experiment room where the investigator provides instructions and presents practice tasks]

"Today, we will have you retell three different stories. We want you to do the best you can in every situation. Before we begin we will familiarize you with the story retell task. You will listen to a story while seeing pictures that go along with the story. After hearing the story and seeing these pictures you will be asked to retell the story in your own words. When retelling the story, you should include as much detail as possible. Do you have any questions? (pause to let participant ask questions) Let's practice one so that you will know what to expect." [investigator proceeds to present the practice story]. (After the story has been presented) "Now tell the story in your own words."

After the story practice

"Another thing that we will ask you to do today is identify tones. You will hear two tones: a high tone that sounds like this [investigator plays 2000 Hz tone] and a low tone that sounds like this [investigator plays 500 Hz tone]. You will push this red button (investigator points) every time you hear the high tone and this blue button (investigator points) every time you hear the low tone. Let's also practice this task. Just listen and push the appropriate button every time you hear the tone." [investigator plays randomly timed tones for ~2 minutes].

After the tone identification practice

"You will tell the story to a couple of different people. As we practiced before, you will simply retell the story as best you can in your own words. After hearing the story from you, they will be brought out of the room and asked to judge how well you retold the story. After you listen to one story we will introduce the next and ask you to respond to this question (present and read the pre-narrative questionnaire) by placing a mark on the part of the scale that best represents your answer. We will also ask you a few questions after each story retell (present the post-narrative questionnaire), which you will respond to by circling the most appropriate answer. Are you ready to begin?"

If yes, begin the experimental protocol

If no, ask "Is there something you are unsure about?" Respond to any concerns and make sure the participant is still willing to participate before proceeding.

Experimental Protocol

Supportive Condition:

"The _______ (*first or second depending on order*) person that you will be talking to is in another room. I will present the story and then exit the room so that I can bring her in after you've heard the story. You will have a moment to meet her and when instructed will retell the story as best you can. Remember to do your best at trying to help her understand and follow the story."

If Dual task was first, "You will not have to do anything else while you tell the story. You will simply retell the story the best you can while, again, doing your best to try and help her understand and follow the story."

After Story Presentation

[Investigator brings in student. Upon entering the room, the student takes a seat across from the participant, shakes her hand, and introduces herself by stating her name, status at UNC, and where she is from—using appropriate rate, tone, and loudness. The student then asks the participant's name.]

If participant is PWA, listener adds, "It's nice to meet you! I've met some people with aphasia before. Even when it's hard, I know that you know what you want to say. You'll do great!"

If participant is NH, listener adds, "It's nice to meet you! I'm sure that you'll do great in this study!"

"You can now respond to this question by placing a mark on the part of the scale that best represents your answer (investigator hands participant the pre-narrative questionnaire). Thank you! I will now step out of the room. You can begin retelling the story as soon as I've exited."

After completing the story retell

[Investigator re-enters room after communication partner has exited] "You can now respond to this questionnaire by circling the most appropriate answers."

<u>Dual Task Condition:</u>

If dual task is first: "The _______ (*first or second depending on order*) person that you will be talking to is in another room. I will present the story and then exit the room so that I can bring her in after you've heard the story. You will have a moment to meet her and, when instructed, will retell the story as best you can. Remember to do your best at trying to help her understand and follow the story."

If dual task is second: "[Next or first depending on order], you will again tell the story to [participant's name]. I will again exit the room while the story is being presented."

"While you retell the story, you will also be asked to push this red button every time you hear a high tone and this blue button every time you here a low tone just like we practiced before. You will do the same thing you did in the practice only this time you will need to tell the story while you do it. Remember to do your best at trying to help her understand and follow the story when you retell it."

After Story Presentation

If dual task is first: follow the procedure outlined in the "*After Story Presentation"* of the supportive condition section for introducing oneself

"You can now respond to this question by placing a mark on the part of the scale that best represents your answer (investigator hands participant the pre-narrative questionnaire). Thank you! I will now begin to play the tones and then step out of the room. After you've finished retelling the story the tones will continue to play until I've returned. You can begin retelling the story as soon as I've exited."

After completing the story retell

[Investigator re-enters room after communication partner has exited] "You can now respond to this questionnaire by circling the most appropriate answers."

<u>Social Challenge Condition:</u>

"The _______ (*first or second depending on order*) person that you will be talking to is in another room. I will present the story and then exit the room so that I can bring her in after you've heard the story. You will have a moment to meet her and when instructed will retell the story to her as best you can. Remember to do your best at trying to help her understand and follow the story."

If after supportive and dual task conditions: "You will not have to do anything else while retelling the story. You will simply retell the story as best you can."

After story presentation

[The listener is looking at her phone when she walks in. The listener looks up after entering the room and introduces herself by stating her name, status at UNC, and where she is from—using a patronizing tone, rate, and volume. Following this introduction, the student listener places her phone on the table in front of her and takes a seat.] "You can now respond to this question by placing a mark on the part of the scale that best represents your answer (investigator hands participant the pre-narrative questionnaire). Thank you! I will now step out of the room. You can begin retelling the story as soon as I've exited."

After completing the story retell

[Investigator re-enters room after communication partner has exited] "You can now respond to this questionnaire by circling the most appropriate answers."

APPENDIX 3.B: LISTENER TRAINING PROTOCOL

Student participants will be trained on supportive and challenging communication behaviors. The socially supportive behaviors that will be trained are consistent with those that have been shown to support conversation in aphasia. Students will be required to demonstrate mastery of both supportive and challenging behaviors before the experiment with PWA begins. Mastery will be demonstrated by having five naïve observers rate the listeners as demonstrating supportive behaviors "frequently" when asked to be supportive and "never/rarely" when asked to be challenging.

Listener training will follow a procedure that first highlights general beliefs and attitudes and then focuses on specific strategies and behaviors that are associated with these beliefs. The attitudes and strategies that will be highlighted have been shown to be important in supporting communication for PWA (Kagan, Black, Duchan, Simmons-Mackie, & Square, 2001; Simmons-Mackie & Kagan, 1999; Turner & Whitworth, 2006). The steps of the training are outlined below:

<u>Module 1: Attitudes</u>

1) Listening Attitude
    a. Inform students that they will view a 3-minute talk about advanced calculus. Warn them that the material may not be interesting or easy to follow but instruct them to try to be as attentive and engaged as possible. [Play video]. Next, tell the students that they will now watch 3 more minutes of the talk but this time do not show any interest or engagement in the material. Pretend like you have a test coming up, somewhere important to be, or something else on your mind. [Play video]. After this experience ask the following questions:
        i. How was your attitude different during each of these clips?
        ii. How did your attitude influence your behavior?
        iii. Discuss what it means to have a "listening attitude" and why this is important when talking to people with communication disorders.
2) Acceptance of PWAs struggles
    a. Educate listeners on aphasia and have them watch five pre-selected video clips from people with varying severities and types of aphasia. Talk about what it means to accept people with aphasia's communication situation and status. What might this look like when talking to a person with aphasia?

<u>Module 2: Communication Strategies</u>

1) Follow-up: think about your experience when we talked about communication attitudes. What we're some of the behaviors that were associated with a listening attitude?
2) Explain that these behaviors demonstrate engagement, respect, and encouragement. The opposite behaviors demonstrate disinterest. Tell the students that they will be learning strategies that support communication but that they will also learn and practice associated strategies that make communication challenging. Present and practice each

of the following strategies by first explaining and modeling the strategy. Next, guide students as they practice using the strategy with each other.

a. Acknowledge Competence -> Failure to Acknowledge Competence
    i. Explain: Acknowledging competence involves explicitly telling PWA that you know they know what they want to say and that their communication is important and valued. This will be done by supportive communication partners before the story retell and whenever the person communicating becomes visibly upset or frustrated.
    ii. List different phrases that could be used to tell this to PWA:
        1. "I know you know what you want to say," "I know what you're trying to say is important"
    iii. Demonstration and guided practice
b. Appropriate Eye Contact -> Lack of Eye Contact
    i. Explain: Eye contact demonstrates interest and attentiveness. Good, appropriate eye contact will help support communication for PWA.
    ii. Demonstration and guided practice
    iii. Inappropriate eye contact can take several forms. List specific examples of inappropriate eye contact:
        1. Glancing around the room, fixating on something in the room, looking at phone or computer screen, looking down
    iv. Demonstration and guided practice
c. Open Body Posture -> Closed Body Posture
    i. Explain: An open body posture includes uncrossed arms and legs and can also involve slightly leaning forward. This is part of supportive communication.
    ii. Demonstration and guided practice
    iii. A closed body posture includes crossed arms and legs and leaning back in your chair.
    iv. Demonstration and guided practice
d. Affiliatives -> Lack of affiliatives
    i. Explain: Affiliatives include positive facial expressions and head nods. These behaviors demonstrate engagement. One does not have to constantly smile and nod but do so at naturally appropriate times throughout the interaction.
    ii. Demonstration and guided practice
    iii. Not using affiliatives (i.e., keeping a straight face and not nodding) show that you are not engaged as a listener.
e. Appropriate tone, volume, and rate -> Patronizing tone, volume, and rate
    i. Explain: Although simple language can be helpful, when talking to PWA you should use a normal tone, volume and rate. Sometimes partners talk to PWA with extra inflection, increased loudness, and greatly reduced rate. This is counter to supportive communication.
    ii. Demonstration and guided practice
f. Acknowledgement Tokens -> Lack of Acknowledgement Tokens

i. Explain: Acknowledgement tokens include verbal expressions of agreement and approval (e.g., I see, that's right, mhm, wow, oh yea).
ii. Demonstration and guided practice
iii. Poor communication partners are less likely to use acknowledgment tokens.

3) Putting it together: Explain that you will now practice putting these strategies together while talking with each other. You will practice being both a supportive and challenging communication partner. Use the table below to remember which strategies to use in each scenario.

Supportive Communication Behaviors	Challenging Communication Behaviors
- Acknowledge competence at beginning and when speaker becomes upset or frustrated	- No acknowledgement of competence
- Maintain good eye contact	- Poor eye contact (e.g., glance around room, fixate on things, look at phone, look down)
- Open body posture	- Closed body posture
- Positive facial expressions and head nods	- Straight face
- Appropriate tone, volume, and rate	- Patronizing tone, volume, and rate
- Verbal expressions of agreement and approval (e.g., mmhm, right, I see)	- No expressions of agreement and approval

Module 3: Practicing with a PWA

1) Follow-up: Review the table of strategies and hold a brief question and answer session regarding the strategies. Spend some time reviewing and practicing any specific strategy as needed.
2) Practice with a PWA. A volunteer PWA familiar with the experimental protocol will help with this session and students will practice supportive and challenging communication behaviors with the volunteer.
3) Treatment task simulation. In the final 10 minutes of this module, the PWA volunteer will complete the story retell task that will be used in the experiment twice with each student. Students will demonstrate supportive behaviors during one story retell and challenging behaviors during the other. Students will be recorded during each simulation and rated by naïve observers to verify mastery.

APPENDIX 4.A: INTERVIEW GUIDE

1. Let's start the discussion by talking about your overall experience during the experiment.
   a. What was easy for you?
   b. What was difficult for you?
   c. What did you notice about the students who listened to your story?

2. Now, let's talk about each specific situation.
   a. How do you think you did at telling the story to [name of socially supportive student] when you did not have to listen for tones? What were your thoughts and feelings during this story retell? What strategies, if any, were helpful?
   b. How do you think you did at telling the story to [name of socially supportive student] when you had to also listen for tones? What were your thoughts and feelings during this story retell? What strategies, if any, were helpful?
   c. How do you think you did at telling the story to [name of socially challenging student]? What were your thoughts and feelings during this story retell? What strategies, if any, were helpful?

3. Was there anything that either student listener did that was particularly helpful/unhelpful? Why do you think these behaviors helped/did not help?

Probes for Discussion:

- *Stress response and any link to speech behavior*
- *Perceived differences between telling the story during the dual task and socially challenging conditions*
- *Self-evaluation of story retell performance*
- *Factors that contributed to ease/challenge of story retell task*
- *Awareness of communication partner behaviors*

APPENDIX 4.B: INITIAL CODEBOOK

Codes and abridged codebook definitions used to analyze interview data and assign meaning units together into themes and subthemes.

Descriptive Code	Brief Definition	Subtheme
Communication partner behaviors*	Mention of specific observable actions of the communication partner that the speaker noticed while retelling the story	I.A, I.B
Judgments about the communication partner*	Descriptions of the speaker's overall impression of the listener or attributions/traits assigned to the listener	I.A, I.B
Emotional reaction to the communication partner*	Comments about the speaker's emotional response to the communication partner	I.D, I.E
Nonsupportive partner distraction	Comments about dividing their attention between the story and nonsupportive partner	II.A
Behavioral reaction to the communication partner*	Comments about how the communication partner influenced the speakers' performance and behavior when retelling the story	II.B
Caution about speaking negatively about partner	Comments indicating that the participant is cautious or unwilling to say anything negative about the nonsupportive partner	Removed
Recognition of intentional lack of support*	Mention of their suspicions that the nonsupportive partner behaviors were intentional	I.C
Emotional reaction to the concurrent task*	Comments about the speaker's emotional response to the concurrent task	I.D, I.E
Concurrent task distraction	Comments about dividing their attention between the story retell and tone discrimination tasks	II.A
Behavioral reaction to the concurrent task*	Comments about how the concurrent task influenced the speakers' performance and behavior when retelling the story	II.C
Story Topic	Comments about what topics or stories they preferred and how the story topic influenced their retell	Removed
Detail	Any mention of specific story details and how they dealt with them	Removed

General attention	Comments related to the speaker's general focus or concentration (i.e., not related to a specific task during the experiment)	Removed
Task prioritization	comments that indicate that they conscientiously chose to focus on one task over another	III.A
Time awareness	Specific mention of the role of time in their performance of the task	Removed
Supportive partner assessment**	Speaker's own judgement about how they did at retelling the story to the supportive partner	II.D
Nonsupportive partner assessment**	Speaker's own judgement about how they did at retelling the story to the nonsupportive partner	II.D
Concurrent task assessment**	Speaker's own judgement about how they did at retelling the story with the concurrent task	II.D
Intentional strategies*	Mention of specific strategies that they used when retelling the story	III.B

*Note.** indicates a code that was subcoded for descriptive purposes and to aid analysis. ** indicates codes that were subcoded according to valence: positive, negative, or mixed. Subcode information was used in assigning themes and determining categories within themes as shown in Table 4.2. Removed indicates that the code was not included in the final organization because it was not directly relevant to the questions of the present analysis.