Spring 2019

Listener Judgements of Fluency and Perceptions of Aphasia

Nicole Khvalabov

LISTENER JUDGEMENTS OF FLUENCY AND PERCEPTIONS OF APHASIA

by

Nicole Khvalabov

A thesis submitted in partial fulfillment of the requirements
for graduation with Honors in the Speech Pathology and Audiology

_____

Jean Gordon
Thesis Mentor

Spring 2019

All requirements for graduation with Honors in the
Speech Pathology and Audiology have been completed.

_____

Yu-Hsiang Wu
Speech Pathology and Audiology Honors Advisor

College of Liberal Art and Sciences
The University of Iowa
Iowa City, Iowa

LISTENER JUDGEMENTS OF FLUENCY AND PERCEPTIONS OF APHASIA

By

Nicole Khvalabov

A thesis submitted in partial fulfillment of the requirements for graduation with Honors in the Department of Communication Sciences and Disorders

Jean Gordon

Thesis Mentor

Spring 2019

Abstract

Background: Aphasia, a neurological disorder caused by trauma to the brain, disrupts a person's ability to communicate effectively. People with aphasia (PwA) are perceived less favorably than their peers. In addition, people with less fluent aphasia are perceived less favorably than people with more fluent aphasia.

Aims: The present study aimed to investigate how listener judgements relating to fluency impact how they perceive the personality characteristics of PwA. In addition, we examined which aspects of fluency had the largest influence on perceptions of personality.

Methods: Seventy-six undergraduate students in a psychology of language class at the University of Iowa listened to and rated speech samples from 24 PwA telling the story of Cinderella. Listeners completed a questionnaire assessing their perceptions of the speech and personality characteristics of the speakers. The listeners rated the speakers on 5 linguistic measures related to fluency: rate of speech, effort, grammar, word retrieval, and understandability. The personality characteristics assessed were intelligence, confidence, and ability to make friends. Additionally, the listeners rated how comfortable they were while listening to the speaker and made a recommendation for speech-language therapy. Listeners also had the option to respond "unable to judge" for each question.

Results: Listeners rated the linguistic measures of the fluent speakers significantly more highly than the nonfluent speakers for all measures (except rate of speech, which approached significance). In addition, listeners rated the personality characteristics of the fluent speakers significantly more favorably than for nonfluent speakers on all measures. Ratings of fluency were significantly associated with ratings of personality, indicating that perceptions of speech ability affect broader perceptions of the speaker.

Discussion: These findings indicate that (a) listeners were able to discriminate differences between the speech of fluent versus nonfluent PwA; (b) undergraduate students' perceptions of PwA are highly influenced by the fluency of the speaker; and (c) listeners showed the most hesitance in judging intelligence of speakers based on their speech samples compared to other aspects of personality. Since fluency plays such a large role in listener perceptions, it is necessary to establish a uniform measure to improve therapy targets and future research. There should also be a stronger push for increasing education about aphasia as well as giving students more opportunities to interact with PwA to try and reduce bias and stereotypes associated with PwA.

Introduction

Aphasia is a neurological disorder resulting from an injury to the brain that disrupts effective production or comprehension of speech and impairs the ability to read or write (National Aphasia Association, n.d.). The older adult population is the most prone to aphasia, with the most common cause being stroke, followed by the less common causes of head trauma, brain tumors, and infection (National Aphasia Association, n.d.). The severity of aphasia may vary widely, from only a single modality of language being affected, such as difficulty with word retrieval, to leaving a person with very few communicative abilities (National Aphasia Association, n.d.). Although this disorder affects an estimated 2.5 million people in America, there is very low public awareness of aphasia (Simmons-Mackie, 2018). When people were surveyed in the United States, only 10.3% of respondents had heard of aphasia, and a scant 1.5% had any basic knowledge of the disorder (Simmons-Mackie, Code, Armstrong, Stiegler, & Elman, 2002).

Depending on which type and the severity of aphasia a person is experiencing, they may be classified as fluent or nonfluent. A person with aphasia (PwA) is categorized as fluent if they can produce connected speech smoothly with little effort, and if their sentence structure is mostly grammatical, although it may lack meaning (ASHA, n.d.). Fluency is thought to have an important role in how speakers are perceived, with studies showing that less fluent speakers are less favorably perceived compared to their fluent peers (Harmon, Jacks, Haley, & Faldowski, 2016; Zraick & Boone, 1991).

Listeners tend to perceive PwA more negatively than people without aphasia (Zraick & Boone, 1991; Croteau & LeDorze, 2001; Allard & Williams, 2008). These perceptions that people make about PwA based on their speech extends to how people view PwA as a whole,

causing listeners to make more negative assumptions about PwA in regard to their cognitive abilities and personality characteristics. Aphasia is a disruption to language and therefore negatively affects a person's ability to communicate. Since communication is deeply embedded in everyday life, it becomes more difficult for PwA with weakened communicative abilities to maintain their relationships and participate in social situations.

Fluency

As cited in Gordon (1998), people have historically attempted to define fluency by quantitative measures such as speech rate (Howes, 1964), phrase length (Goodglass, Quadfasel, & Timberlake, 1964), and pause time (Feyereisen, Verbeke-Dewitte, & Seron. 1986). Similarly, qualitative measures such as repair attempts (Marshall & Tompkins, 1982; Goodglass et al. 1964), grammatical form (Goodglass, Christiansen, & Gallagher, 1993), and error production (Hofmann, 1980) have been advocated for. These overlapping measures give rise to disagreement in fluency classifications (Gordon, 1998).

The need to establish an agreed upon classification for fluency has been demonstrated by the inability of clinicians to uniformly agree on fluency classifications in past studies. Gordon (1998) aimed to identify the level of agreement among speech-language pathologists on their ratings of fluency. Twenty-four speech-language pathologists were tasked with making judgements of fluency and clinical diagnoses of 10 speakers with aphasia. The clinicians were also asked to rate each subject according to the 6 expressive rating scales of the *Boston Diagnostic Aphasia Examination* (BDAE; Goodglass & Kaplan, 1983) profile including melodic line, phrase length, articulation, grammaticality, paraphasia, and word-finding ability. Finally, the clinicians shared what systems of classification they employ and how frequently. The most common systems of classification were severity and modality of impairment, with fluent versus

nonfluent classification following behind. Out of all 10 subjects, only 3 were unanimously rated in fluency judgements. One patient was unanimously rated as fluent and two patients were unanimously rated as nonfluent. Two of the subjects had agreement rates of 71% while the remaining 5 only had agreement ratings roughly around 50%. It is important to note that almost half of the clinicians reported using fluent versus nonfluent 'always' or 'almost always' in determining a patient's profile, despite the lack of agreement on fluency. This illustrates the problem that the field is facing and shows that, in order to appropriately use fluency as a system of classification, we must first come to a consensus on how to determine each of these categories.

More recent studies have tried to home in on specific perceptual cues that influence how a listener judges fluency. Park, Rogalski, Rodriguez, Zlatar, and Benjamin et al. (2011) investigated the perceptual cues that contribute to a listener's judgement of fluency by having listeners rate speech samples. Narrative speech samples of 41 English-speaking adults with varying frontal and temporal lobe pathologies and 20 non-brain-damaged older adults were used for this study. Two groups of experienced speech-language pathologists listened to and rated these speech samples. The first group's task was to rate the amount of audible struggle, and the second group's task was to judge each speaker as either fluent or nonfluent.

The authors assessed each narrative on the basis of 5 measures: speech rate, syllable type-token ratio (TTR), speech productivity, audible struggle, and filler ratio. The authors defined speech rate as the number of syllables produced per second, calculated by dividing the total number of syllables by the total time speaking, not including silences. Syllable TTR measures the proportion of unique syllables spoken during the narrative. Speech productivity represented how much of their narrative the speaker was verbalizing. This was calculated by dividing

speaking time without silences by the total speaking time including silences. Audible struggle was judged by the authors as the amount of vocal tension and articulatory effort perceived in each narrative. Filler ratio determined how much of the narrative consisted of fillers, such as 'like' and 'um,' that reflect a speaker's struggle to proceed in a sentence. This was measured by dividing the total amount of time that a speaker produced fillers by the total speaking time without silences.

Of the 5 perceptual cues analyzed in the narratives, significant differences between nonfluent and fluent individuals were found in speech rate, speech productivity, and audible struggle. Of these variables, the authors found that speech productivity (amount of speaking time vs pause time) was the most influential in judging language fluency, indicating the important role that pauses play in listener perceptions of fluency. Narrowing down on the speech characteristics that contribute to fluency is important when examining how fluency plays a role on perceptions.

Negative Perceptions of PwA

Several studies have examined the perceptions of PwA in order to see if aphasia influences the way people are perceived. Allard and Williams (2008) investigated the impact of certain speech and language disorders on listener perception. Four-hundred and forty-five participants listened to speech samples representing disorders of articulation (an interdentalized lisp), fluency (stuttering), language (Wernicke's aphasia), and voice (hoarseness), as well as no disorder. The speech samples came from a single actor who was coached on the various disorders. After listening to the samples, the listeners rated the individual on various characteristics of personality and language ability. Listeners rated the individual in the aphasia condition lower on decisiveness and reliability and higher on stress than all other conditions. The individual in the aphasia condition was rated lower on self-esteem and social adjustment than all

the other conditions except the fluency disorder condition. This shows that, even among other disorders pertaining to speech and language, aphasia was perceived the most negatively in several categories, which illustrates the negative social consequences the disorder may bring to an individual. Furthermore, the finding that the fluency disorder was the only one rated as low as aphasia on self-esteem and social adjustment demonstrates how being less fluent plays a significant role in negative perceptions about personality. A limitation of this study is that they did not compare fluent and nonfluent aphasia, which Harmon and colleagues (2016) were able to accomplish.

Harmon and colleagues (2016) investigated listener perceptions as a function of speech fluency by presenting speech samples in several conditions. The speech samples were selected from the *AphasiaBank* database (MacWhinney, Fromm, Forbes, & Holland, 2011) and included 9 different speakers producing monologues. Three of the speakers were neurologically healthy, while the remaining 6 were nonfluent PwA. In the first condition, speech samples from the neurologically healthy individuals were presented. In the second condition, speech samples from individuals with nonfluent aphasia were presented. In the third condition, the speech samples of the nonfluent PwA were modified to sound more fluent. The authors simulated fluent speech by eliminating markers of nonfluent speech such as long pause times, fillers, and repetitions.

The listeners—18 undergraduate students and 18 SLP graduate students—were asked to assess their perception of the speakers' speech output, personality characteristics, and how the listener felt. The neurologically healthy speakers were perceived more favorably in every judgment than both the simulated and unmodified speech samples from PwA. However, the speech samples that had been modified to be more fluent were rated as more intelligent, confident, competent, and friendly by listeners than the unmodified samples. In addition,

listeners stated that they felt more comfortable when listening to these samples than to the unmodified speech samples. Furthermore, the finding that the same person's speech, when modified to sound more fluent, received more positive listener perceptions indicates that increased fluency has a direct relationship to a more favorable perception from listeners. Interestingly, the graduate students rated the speakers with aphasia as significantly more intelligent and intelligible than did the undergraduate students. The graduate students' more favorable perceptions of the aphasic speech samples relative to the undergraduate students may reflect the positive impact of the adult neurogenic communication disorders class that the graduate students had taken prior to the experiment.

Negative perceptions of PwA do not just occur with strangers. Studies examining perceptions of PwA have indicated that even those closest to PwA perceive them more negatively than peers perceive their spouses without aphasia. Zraick and Boone (1991) investigated the attitudes of individuals who had a spouse with fluent aphasia (n=15) or nonfluent aphasia (n=15) compared to a control group of spouses of persons without aphasia (n=30). All the spouses sorted written statements into categories, based on how representative that statement was of their spouse. The authors found that spouses of PwA, regardless of fluency, listed "demanding" and "temperamental" as the most prevalent characteristics of their spouses. "Immature," "worrying," "nervous," and "confused" were also highly prevalent. The least prevalent characteristics were "independent," "sexy," "mature," and "intelligent." The control group, however, listed "mature" as the most prevalent characteristic while "demanding," "immature," "nervous," and "confused" were among the least prevalent characteristics. When comparing the spouses of fluent and nonfluent PwA, the authors found that the spouses of fluent PwA had significantly higher scores than the spouses of nonfluent PwA for "independence,"

"compliance," and "sociability," indicating again, that increased fluency results in more positive perceptions. Even in the home space, which is supposed to bring comfort and support to people, PwA still suffer social and personal consequences from their disorder.

Croteau and Le Dorze (2001) reinforced this finding in their investigation of how spouses of PwA (n=21) view the personality of their spouse compared to a control group of individuals whose spouses do not have aphasia (n=25). Using the Adjective Check List (Gough & Heilbrun, 1983), participants checked the adjectives that best described their spouse. The results showed five main categories with a significant difference between two groups: likability index, achievement scale, endurance scale, order scale, and succorance scale. According to the likability index, spouses of PwA rated their spouse lower on the adjectives reflecting likability. Based on the achievement scale, women perceived that their husbands with aphasia did not strive enough to succeed in ventures that are valued socially. On the endurance scale, wives also judged their husbands with aphasia as less persistent than wives judged their husbands without aphasia. Spouses of PwA rated their spouse lower on the order scale (reflecting neatness, organization, and planning) than spouses of persons without aphasia rated their spouse. Finally, the results showed that spouses of PwA rated their spouse higher on the succorance scale than spouses of persons without aphasia rated their spouse, indicating that they thought they solicited sympathy and support from others.

The authors make note of a finding by Thompson, Sobolew-Shubin, Graham, and Janigian (1989) that persons who suffered a stroke felt more depressed when their spouse perceived them more negatively. This shows the large influence that spousal perceptions can have on the relationship, as well as how PwA view themselves. When considered with the evidence that spouses of PwA perceive their spouse more negatively than do spouses of persons

without aphasia, this highlights the negative consequences to self-esteem and mental health that come with the negative perceptions people have of PwA.

Social Lives of PWA Compared to Peers Without Aphasia

It is important to understand how these negative perceptions manifest in the way people act towards PwA and how this affects PwA's ability to navigate the social sphere. Parr (2001) analyzed the psychosocial aspects of aphasia from her 2-and-a-half-year study that comprised in-depth interviews from 50 PwA who had been living with the disorder for at least 5 years. The initial study (Parr & Byng, 1997) found that the impacts of aphasia are "extensive and complex, direct and indirect, organically interconnected, systemic, ongoing, mercurial and diversely experienced and interpreted" (Parr, 2001, p. 266). Furthermore, she found that PwA encountered attitudinal barriers while in public that prevented them from being able to successfully re-integrate into society. These barriers included prejudice, pity, ignorance, and stigma. Several PwA noted the feeling of being completely ignored in public, and if people did notice the PwA, they either didn't care enough to engage with PwA, or assumed incorrectly that PwA were of lower intelligence or had some sort of different disorder. These findings highlight the shared experience of many PwA who must deal with the negative social consequences of how they are perceived.

The discrimination that PwA face, as well as the shared experience of many PwA noting that the public at large does not understand their disorder, may in part be attributed to the extremely low awareness of aphasia. As stated earlier, public knowledge of aphasia ranges only between 1.5 and 10.3% (Simmons-Mackie et al., 2002). This lack of awareness results in the vast majority of people not understanding PwA or their disorder. This, combined with the communication weakening that aphasia causes, can result in PwA feeling even more isolated.

This isolation is apparent when examining the social lives of PwA compared to their peers who are neurologically healthy.

In order to further understand the far-reaching consequences of communication disability, Cruice, Worrall, and Hickson (2006) investigated differences in social contacts and activities between 30 PwA and 71 healthy people who were age-and education-matched. All participants were asked to name people they considered important to them in their life, indicating how close they felt to each person. Their relationships were analyzed with the use of the *social network convoy model* (Antonucci & Akiyama, 1987) in which the person being interviewed had 3 concentric circles surrounding them with each circle representing a level of closeness between the person and their social contact. PwA had an average of 21 people in their total networks, while participants without aphasia had an average of 30 people. Additionally, PwA had most of their social contacts concentrated in their inner circle with their outer circle containing fewer people, while the participants without aphasia seemed to have their social contacts more evenly distributed between the three circles. Having fewer people in their social networks indicates that it is more difficult for PwA to maintain relationships, especially outside of family.

Participants also completed the *Social Activities Checklist* (Cruice, 2001, in Worrall & Hickson, 2003) a 20-item measure that records leisure, informal, and formal social activities. Responses showed that PwA participated in an average of 13 social activities. However, 56.7% said they were not satisfied with their level of activities and wanted to be doing more. The participants without aphasia participated in an average of 16 social activities with only 16% saying they wanted to be engaging in more social activities. The dissatisfaction that PwA feel about their social participation suggests that it's not by their own choice that they are

participating in social spheres less and shows how aphasia can be a barrier to fully participating in society.

Hilari and Northcott (2017) sought to compare the social networks and perceived social support of people who had experienced a stroke (with and without aphasia) to healthy older adults. The participants were comprised of 106 healthy older adults, 60 stroke patients without aphasia, and 11 stroke patients with aphasia. All participants completed the Medical Outcomes Study Social Support Survey (Sherbourne & Stewart, 1991), which assesses the patient's perception of available functional social support, and the Stroke Social Network Scale (Northcott & Hilari, 2013), which assesses the number of members in one's social network, the frequency of contact, and satisfaction with their network. The authors found that out of a possible score from 0-100, with higher scores indicating better social networks, healthy participants had a mean social network score of 64.7, participants with stroke and no aphasia had a mean score of 58.6, and participants with aphasia had 46.7. The healthy older adult participants had a significantly higher mean score than participants who had a stroke without and with aphasia. The participants who had a stroke without aphasia also had a significantly higher mean score than the participants with aphasia.

In addition, a "friends" score was calculated which ranged from 0-100 with higher scores indicating a greater satisfaction in friendships. The healthy older adult participants had an average "friends" score of 53.1, the participants with stroke and no aphasia had an average score of 47.0, and the participants with aphasia had an average score of 27.4. The scores of the healthy participants were significantly different from both the participants who had a stroke without aphasia and the participants who had aphasia. In addition, the participants who had a stroke without aphasia had a significantly higher "friends" score than the participants with aphasia. The

results suggest that, after stroke, people with aphasia see a more pronounced friendship loss than stroke survivors who do not have aphasia. This demonstrates the negative impact of aphasia on individuals as they navigate the social sphere and try to maintain connections.

The lessened amount of social interaction and social activity may in part be due to the comfort levels of people who speak to PwA. Lasker and Beukelman (1999) assessed peer reactions to a PwA telling a story in three different storytelling modes. In the first mode, the adult with aphasia, a 72-year-old with moderately severe anomic aphasia, told the story naturally, without any assistance. In the second mode, an AAC notebook with components of the story written out was utilized. In the third mode, an AAC device with a pre-recorded message was used to deliver the story. The message was recorded by an age- and gender-matched neurologically healthy speaker, and the speaker with aphasia pressed buttons on the AAC device to present the story. The peers (30 older adults) were asked to rank the video clips based on which mode they preferred the PwA to use if they were interacting with them. In addition, peers evaluated the speaker's effectiveness and competence as a communicator, peer comfort and level of understanding, and how willing the peer would be to engage with the speaker. A group interview was also conducted after the peers viewed the videotapes.

The authors found that only 13% of peers preferred the speaker's natural, unaided speech, while 77% ranked this mode as their least preferred mode. Peers felt that the speaker was the least competent and lest effective as a communicator when using his natural speech. Peers also felt the least comfortable, were willing to engage the least, and had the lowest level of understanding when watching the natural speech videotapes. During the interview, peers commented that noticing tension and difficulty for the speaker to get his message out left them feeling more uncomfortable. Peers also reported feeling uncomfortable when they couldn't help

the speaker. This study highlights how peer perceptions of PwA are negatively impacted by the lower level of understandability that aphasia causes. The relationship between understandability and comfort/willingness to engage is also important to consider when trying to understand why PwA engage in fewer social activities and interactions.

The Present Study

Past studies investigating listener perceptions of PwA have not asked listeners to make judgments about fluency as well as personality characteristics of the speaker. The aim of this study is to directly assess how listener judgments relating to fluency impact how they perceive the personality characteristics of PwA. Furthermore, we are investigating which (if any) aspects of fluency are the most strongly linked to perceptions of personality. This may help narrow down which speech components are the most important in determining fluency and may aid in the establishment of a uniform measure of fluency.

Based on past research yielding differences in perceptions between more and less fluent individuals (e.g. Allard & Williams, 2008; Harmon et al., 2016), we predict that listeners in this experiment will be able to perceive the differences between fluent and nonfluent speech by rating the speech characteristics relating to fluency more highly for fluent speakers than for nonfluent speakers. In addition, we predict that listeners will support past findings by rating the personality characteristics of fluent speakers more favorably than their nonfluent peers (Allard & Williams, 2008; Harmon et al., 2016).

Methods

This experiment was approved by the IRB of the University of Iowa, and the listeners signed an informed consent document before beginning the experiment. The speakers whose

audio samples were used had previously signed an informed consent to have their data used before their samples were put on *AphasiaBank* (MacWhinney et al., 2011).

Speakers

Audio samples of PwA describing the story of Cinderella to a clinician were obtained from *AphasiaBank (*MacWhinney et al., 2011). Initially, a set of 185 files were chosen to be analyzed for a larger project. These audio samples were uploaded by clinicians from a variety of sites and represented speakers from across the country. For the current study, these files were filtered down by the following selection criteria. First, files with missing clinical judgements (type of aphasia, fluency judgements) were deleted. Next, files over 5 minutes, and files with fewer than 10 or more than 20 utterances were excluded in order to make the length as similar as possible across samples, reducing the impact that sample length might have on perceptions. Then, files with greater than 70% pausing were excluded to give listeners an adequate amount of speaking time to base their judgements on. The aphasia quotient (AQ) is the overall severity score obtained from the *Western Aphasia Battery* (WAB; Kertesz, 1982). Speakers with AQs over 90 were excluded to ensure that aphasia had a significant enough effect on their speech for listeners to detect. The remaining 36 samples were then sorted by speaker sex. Additional samples were deleted to result in a set of 24 that was evenly divided into men and women and fluent/nonfluent speakers. The files came from 16 different sites with no more than 3 samples coming from the same site.

The final set of 24 speakers consisted of a variety of aphasia types (Broca, Wernicke, Conduction, Anomic, Transcortical). The range of aphasia severity based on AQs was 28-85. The Spontaneous Speech Scale, which reflects the grammatical complexity, meaningfulness, and fluency of speech, ranged from 2-9 out of a possible 10 points. According to WAB criteria,

Spontaneous Speech Scale scores of 0-4 indicate a nonfluent speaker and scores 5-10 indicate a fluent speaker. T-tests showed that there was no significant difference between gender groups on AQ scores ($p = .801$), Spontaneous Speech Scale scores ($p = .606$), or any of a set of linguistic measures potentially linked to fluency perception: total number of utterances ($p = 1.000$), mean length of utterance ($p = .519$), rate of speech ($p = .729$), proportion of retraces, or how many times they corrected themselves ($p = .662$), and percent pause time ($p = .834$).

Table 1 shows the differences between the fluent and nonfluent speakers. T-tests showed no significant difference between fluent and nonfluent speakers in age ($p = .988$) or AQ scores ($p = .078$). The fluent and nonfluent speakers significantly differed in their Spontaneous Speech Scale scores ($p < .001$) since that score determines their fluency classification. The fluent and nonfluent speakers did not significantly differ in the length of their speech samples ($p = .125$) or percent pause time ($p = .533$), as we included length and percent pause time as part of our criteria when filtering the speech samples to be used for the study. When comparing the fluent and nonfluent speakers on the set of linguistic measures potentially linked to fluency perception, the groups only significantly differed on their mean length of utterance ($p = .001$). However, two other measures approached significance: rate of speech ($p = .057$) and proportion of retraces ($p = .053$). Fluent and nonfluent speakers did not significantly differ in their total number of utterances ($p = .653$).

Table 1: Speaker information

Spkr	Age (yrs)	Sex	WAB AQ	WAB Spont Spch	WAB Type	Total Utts	MLU (wds)	Rate of Speech (wpm)	Re-trace	Length (sec)	Pause Time (%)
Fluent Speakers											
S170	63	F	66.4	8	TCS	19	7.37	133.13	3	65	0.167
S055	43	F	70.4	5	CON	20	3.70	27.27	5	223	0.555
S135	56	F	73.4	5	CON	13	3.46	15.82	3	225	0.687
S066	81	F	83.6	6	ANO	16	8.69	42.29	13	245	0.439
S129	32	F	85.0	9	ANO	17	6.59	27.67	3	268	0.305
S010	70	M	28.2	5	WER	13	7.00	71.84	1	81	0.337
S005	48	M	57.4	5	WER	17	5.29	62.67	4	95	0.206
S053	77	M	61.4	8	CON	18	8.06	65.91	11	134	0.326
S110	85	M	75.1	6	ANO	14	8.27	29.85	5	203	0.309
S072	63	M	75.5	7	CON	11	6.82	77.00	9	80	0.317
S025	58	M	77.9	6	CON	15	8.27	31.53	6	243	0.595
S147	71	M	84.0	9	ANO	13	6.85	98.57	8	97	0.551
Mean	62.3		69.8	6.6		15.5	6.7	57.0	5.9	163.3	0.4
Nonfluent Speakers											
S036	76	F	45.5	4	BRO	15	4.50	37.84	12	164	0.463
S158	46	F	53.4	4	BRO	14	2.21	38.75	2	61	0.318
S038	58	F	57.8	4	BRO	14	4.29	44.29	2	89	0.145
S117	62	F	58.1	4	BRO	11	4.90	33.27	1	103	0.440
S119	65	F	59.5	4	BRO	12	2.58	37.74	2	77	0.637
S001	69	F	63.9	2	BRO	15	5.46	34.53	3	183	0.345
S008	75	F	72.6	4	TCM	17	6.47	55.12	1	132	0.442
S031	42	M	59.6	4	BRO	14	3.08	31.11	3	100	0.470
S185	55	M	59.7	4	BRO	13	1.39	12.41	1	91	0.502
S018	71	M	59.8	2	TCM	18	5.72	41.42	3	162	0.411
S050	64	M	61.2	4	BRO	20	1.90	24.26	1	103	0.560
S093	63	M	73.2	4	TCM	17	4.65	29.46	6	195	0.515
Mean	62.2		60.4	3.7		15	3.9	35.0	3.1	121.7	0.4
t-test	.988		.078	**<0.001**		.653	**.001**	.057*	.053*	.125	.533

Spkr = Speaker; S = subject; AQ = Aphasia Quotient; Spont Sp = Spontaneous Speech Scale score; WAB Type = type of aphasia according to the *WAB* (TCS = transcortical sensory; CON = conduction; ANO = anomic; WER = Wernicke's; BRO = Broca's; TCM = transcortical motor); Total Utts = total number of utterances; MLU = mean length of utterance.

Listeners

The listeners were recruited from an undergraduate-level psychology of language class. Students in the class had the option of participating in the experiment to fulfill a mandatory class assignment. Seventy-six students participated in the survey. From the listener demographic information section of the questionnaire, we obtained the following information. Eight of the listeners were male and the remaining 68 (89%) were female. Listener age distribution is shown in Figure 1. A majority of the listeners (95%) were between 18- and 23-years-old. A majority (93%) of the listeners were speech and hearing sciences majors, as shown in Figure 2.

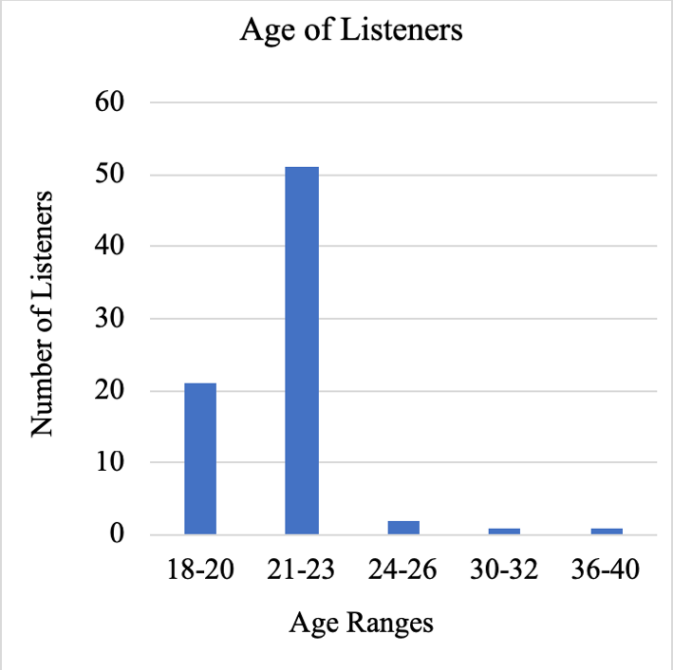

Figure 1. Listener age distribution

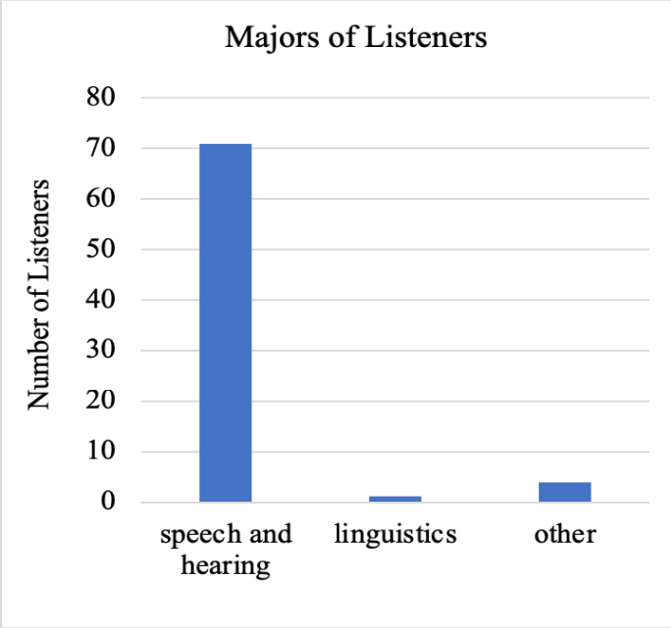

Figure 2. Listener major distribution

Students were also asked about their familiarity with aphasia, to determine if having knowledge about aphasia influenced the judgements they made. They were asked what they know about aphasia on a scale of 1 to 5, with 1 meaning "I have never heard of it," and 5 meaning "I know a lot about it." Finally, they were asked if they had ever met someone with aphasia. Figure 3 shows responses to the question, "What do you know about aphasia?" None of the listeners responded 1 or 2, meaning all of the listeners indicated that they had at least a "little bit" of knowledge about aphasia. Most listeners (59%) responded 4, meaning, "I know a fair amount about it." Figure 4 shows responses to the question, "Have you ever met someone with aphasia?" Most of the listeners (59%) were unsure if they ever met someone with aphasia while 36% responded that they have.

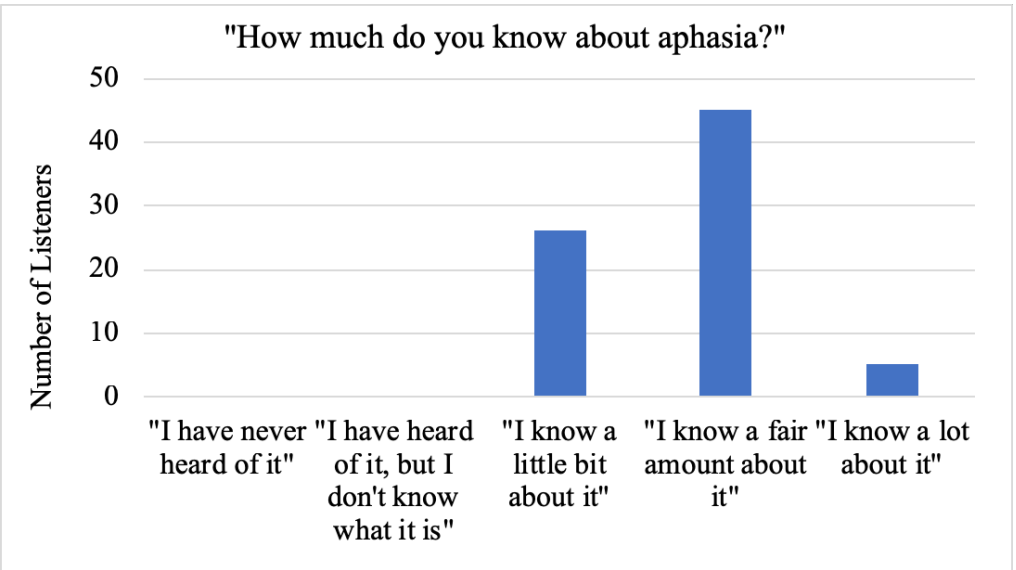

Figure 3. Listener knowledge about aphasia

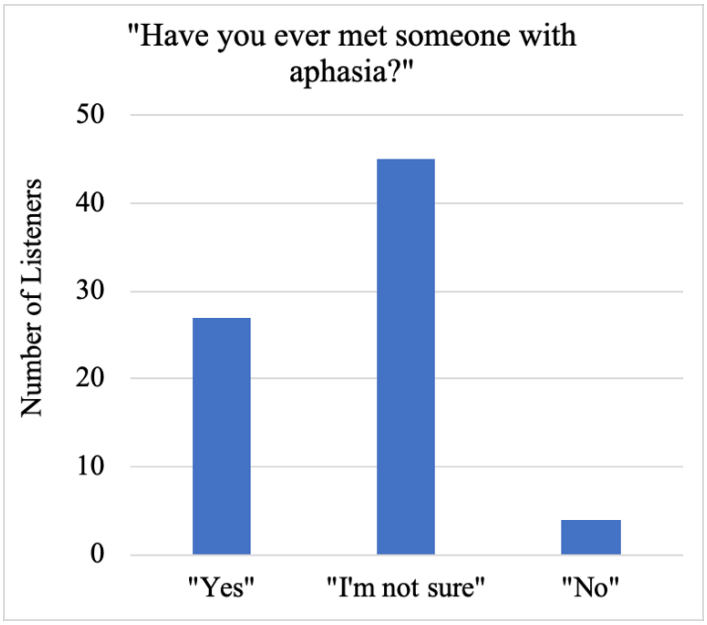

Figure 4. Listener familiarity with aphasia

Questionnaire

The questionnaire began with collecting data on the listeners, as described above. Following the listener demographic and aphasia knowledge questions, listeners rated the speech samples. The questions about the samples were chosen to assess listener perceptions about

fluency and personality characteristics of the PwA, reflecting past findings about negative perceptions of PwA discussed in the literature review. The questions were as follows:

1) *How is the speaker's rate of speech during this sample?* The scale ranged from "very slow" to "abnormally fast". Rate of speech has been shown to be an important linguistic measure in judging fluency (Park et al., 2011; Harmon et al., 2015; Howes, 1946).

2) *How effortful is the speaker's articulation during this sample?* The scale ranged from "very effortful" to "not effortful at all". Park et al. (2011) showed that audible struggle significantly differed between fluent and nonfluent PwA.

3) *How grammatical are the speaker's sentences during this sample?* The scale ranged from "no grammatical sentences" to "normal sentence structure". Grammaticality of speech has been considered very important in defining fluency (Goodglass et al., 1993; Gordon, 1998).

4) *How easily and accurately does the speaker retrieve words during this sample?* The scale ranged from "very difficult and/or inaccurate" to "easy and accurate". Gordon (1998) found that word-finding ability was one of the three most important features for clinicians in their determinations of fluency.

5) *How easy was it to understand the speaker?* The scale ranged from "very difficult" to "very easy". Listeners have commented on the difficulty of understanding speech from PwA and how that negatively impacts the interaction (Lasker & Beukelman, 1999).

6) *How intelligent do you think this speaker is?* The scale ranged from "not intelligent at all" to "of normal intelligence". Aphasia has been linked to negative perceptions

regarding the cognitive abilities of the PwA (Parr, 2001; Zraick & Boone, 1991; Harmon et al., 2016; Allard & Williams, 2008).

7) *How confident do you think this speaker is?* The scale ranged from "not confident at all" to "very confident". Aphasia and lower levels of fluency have been linked to lowered perceptions of confidence (Zraick & Boone, 1991; Allard & Williams, 2008; Harmon et al., 2016).

8) *How easy do you think it would be for this person to make friends?* The scale ranged from "very difficult" to "very easy". Harmon et al. (2016) found that among speech samples from PwA, neurologically healthy speakers, and aphasic speech samples simulated to sound more fluent, listeners perceived the PwA as being the least friendly. In addition, studies show that PWA have fewer social contacts and engage in fewer social activities than their neurologically healthy peers (Cruice et al., 2006; Hilari & Northcott, 2017).

9) *How comfortable would you feel talking to this person?* The scale ranged from "very uncomfortable" to "very comfortable". Many listeners express more discomfort when listening to less fluent speakers (Harmon et al., 2016; Lasker & Beukelman, 1999).

The last question was a multiple-choice question which asks if the listener thinks the speaker needs speech-language therapy. The possible answers are definitely, probably, I'm not sure, probably not, or definitely not.

Procedure

The listeners were asked to listen to 12 of the audio samples that were randomly selected from the set of 24 and to answer the questions on the questionnaire. Thus, each speaker was rated

by about half of the listeners. In fact, because the speakers were randomly selected, the number of listeners who rated each speaker ranged from 31 to 44. The audio samples were presented in random order to reduce possible drift effects that certain audio samples may have on listeners. For example, if the first audio sample contained a very nonfluent speaker, the listener may rate the next speakers as more fluent by comparison. Before the experiment began, listeners had a practice sample so they could familiarize themselves with all of the questions. Once the listener heard the speech sample, they were asked to answer the first 9 questions from the questionnaire using a visual analog scale (VAS, ranging from 0-100), using a sliding bar. The listener had the choice of indicating their answer somewhere on the line from one extreme to the other or selecting "unable to judge". The questions were also presented in random order to reduce possible order effects. The final question asking about the speaker's need for speech-language therapy was always presented last.

Analysis

Data Clean-Up. In order to eliminate the possible influence of random responses, we identified and removed all VAS responses that were +/- 2 SD from the mean rating for that question for that speaker. We then calculated the percent of responses made by each listener that were outliers. All but one listener produced between 1% and 11% of outliers, but for one listener, approximately 19% of judgements consisted of outliers. This participant was excluded. Next, we analyzed the number of times that participants answered, "unable to judge". Most listeners made this response between 1% and 13% of the time, but two listeners were well outside this range: one had 74.2% of responses as "unable to judge" and the other had 30.8%. All the data from these two participants was also excluded. After removing outlying responses and listeners, we

were left with 73 listeners, (66 F, 7 M). In total, we eliminated 495 data points, 5.6% of the total responses.

Statistical Approach. Independent t-tests were conducted to compare the means of fluent and nonfluent speakers on each of the ratings, to determine whether fluent and nonfluent speakers could be differentiated by the students. To do this, we averaged ratings across listeners for each speaker on each question and then calculated the mean ratings on each question for the 12 fluent and 12 nonfluent individuals. Independent t-tests were also conducted to compare the number of "unable to judge" responses between fluent and nonfluent individuals. Since responding "unable to judge" indicates the listener didn't have adequate information to make a judgement, we wanted to examine if the listeners felt that any of the characteristics couldn't be judged based on speech. To determine the influence that perceived fluency characteristics had on perceptions of personality, we conducted correlational analyses.

Results

Differences between Fluent and Nonfluent PwA

There were significant differences between fluent and nonfluent speakers on every rating (except rate of speech, which approached significance), as shown in Figure 5. Fluent speakers were consistently perceived more favorably on personality characteristics and rated higher on speech characteristics relating to fluency. As predicted by the first hypothesis, fluent speakers were perceived to produce speech marginally more quickly ($p = .058$), with less effort ($p = .037$), to produce speech that was more grammatical ($p = .003$), to retrieve words more accurately and easily ($p = .019$), and to be more understandable ($p = .019$). Since listeners were able to discriminate the differences between fluent and nonfluent speakers based on the speech

characteristics relating to fluency, it validates the ratings, indicating that listeners were making accurate ratings based on what they heard.

In addition, these fluency perceptions affected ratings of personality and listener feelings. Fluent speakers were judged to be more intelligent ($p = .017$), more confident ($p = .027$), and better able to make friends ($p = .021$). Listeners also felt more comfortable listening to fluent speakers compared to nonfluent speakers ($p = .019$). This data supports our second hypothesis, showing that listeners perceive the personality characteristics of fluent speakers more favorably than nonfluent speakers.

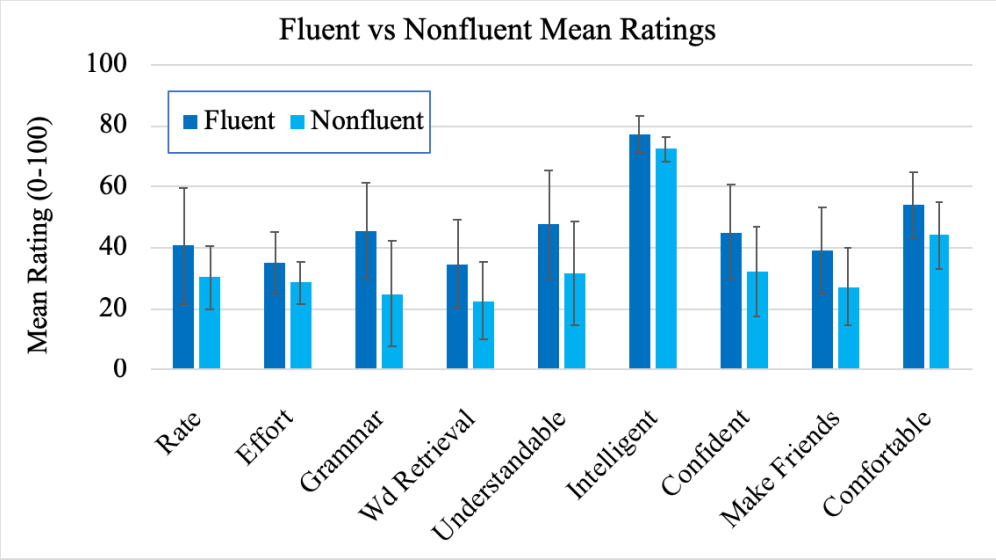

Figure 5. Comparison of fluent *vs* nonfluent ratings

Fluency also played a role in listener recommendations for speech-language therapy, as shown in Figure 6 ($p = .016$). Fluent speakers had a mean rating of 1.7, indicating that most listeners thought fluent speakers "probably" needed speech-language therapy, compared to a mean rating of 1.3 for nonfluent speakers, indicating that most listeners thought nonfluent speakers "definitely" needed speech-language therapy. Although there was a significant

difference between recommendations for speech-language therapy, the means suggest that most listeners thought all speakers needed speech-language therapy to some degree.

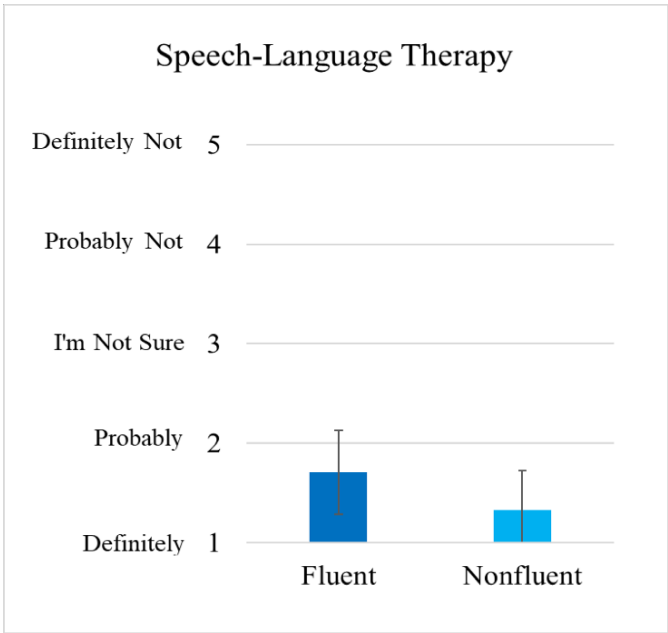

Figure 6. Listener recommendations for speech-language therapy

Inability to make judgements

When comparing the results for fluent and nonfluent speakers by the number of "unable to judge" responses, the perception of the ability of speakers to make friends was the only question that showed a significant difference ($p = .010$), as shown in Figure 7. Listeners responded "unable to judge" significantly more for fluent speakers (1.25 mean responses across speakers) than nonfluent speakers (0.33 mean responses across speakers) on this question. This suggests that listeners felt more hesitance judging fluent speakers' ability to make friends than judging non fluent speakers. This may indicate the perception that nonfluent speakers would encounter a harder time making friends due to their speech abilities than fluent speakers.

Of all the judgments that listeners had to make, intelligence had the most "unable to judge" responses for both fluent (4.42 mean responses across speakers) and nonfluent speakers (4 mean responses across speakers). This shows hesitance of listeners to make judgments about the intelligence of the speakers based on their speech samples, suggesting some listeners knew that aphasia does not impact intelligence and/or listeners felt that intelligence could not be measured by speech characteristics. However, most listeners still felt able to make a judgment on listener intelligence, shown by a significant difference in the mean ratings for intelligence between fluent and nonfluent individuals. This indicates that, overall, listeners associate lowered fluency to lower intelligence.

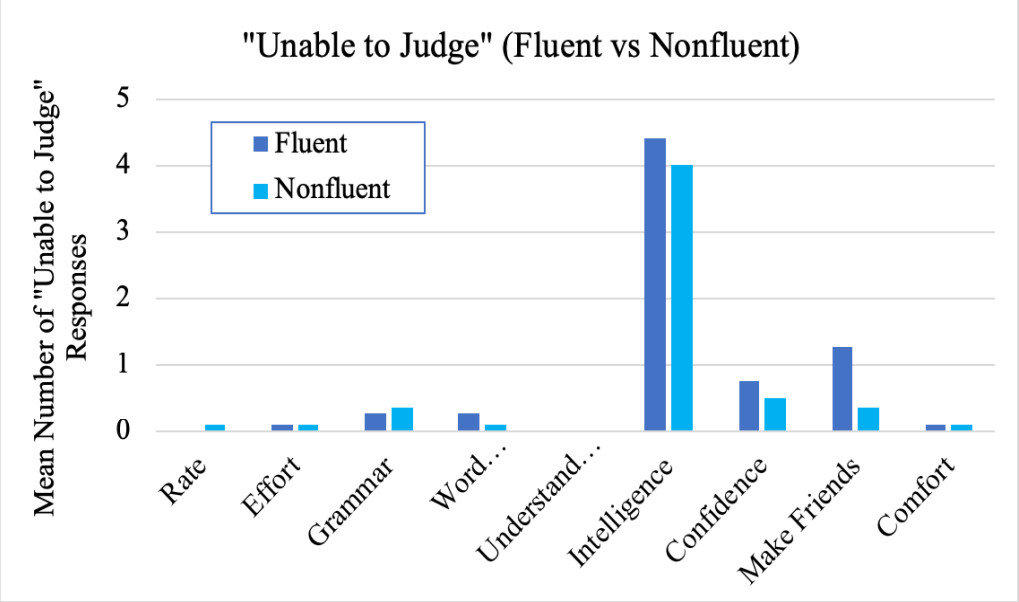

Figure 7. Comparison between fluent and nonfluent speakers in listener inability to judge

Table 2 shows the correlations between fluency ratings and personality characteristics. The correlational analyses among the fluency ratings and the personality characteristics showed that all of the ratings and personality characteristics were highly intercorrelated. Due to this, we

used a very conservative r value (r > .800) to report only very strong relationships between fluency measures and personality characteristics.

Table 2: Correlations between ratings of linguistic measures and ratings of personality characteristics

Rating	Intelligence	Confidence	Ability to Make Friends	Comfort of Listener	Need for S-L therapy
Rate	0.613	**0.895**	0.729	0.626	0.725
Effort	0.744	0.715	0.883	0.856	0.874
Grammar	**0.779**	0.663	0.912	0.919	0.902
Word Retrieval	0.735	0.879	**0.957**	0.899	**0.942**
Understandability	0.755	0.659	0.932	**0.940**	0.888

r-values > .70
r-values > .80
r-values > .90

Bolded numbers indicate the linguistic measure that had the largest influence on the ratings for each personality characteristic

There was no perceived fluency characteristic that reached our conservative effect size (r > .800) for intelligence perceptions, although grammar came close at r = .779, as shown in Figure 8. This suggests that perceptions of intelligence were less strongly influenced by speech characteristics than the other personality characteristics. This may be tied to the hesitance some listeners displayed when making intelligence judgements, reflecting that fluency had less impact on intelligence ratings compared to the other personality characteristics. The perceived rate of speech by listeners was the fluency characteristic that most highly influenced confidence ratings (r = .895), followed by word retrieval (r = .879), as shown in Figure 9. The most important fluency characteristic that influenced listener perceptions of the speaker's ability to make friends was word retrieval (r = .957), as shown in Figure 10. Perceived ability to make friends was also highly influenced by understandability (r = .932), grammar (r = .912), and effort (r = .883).

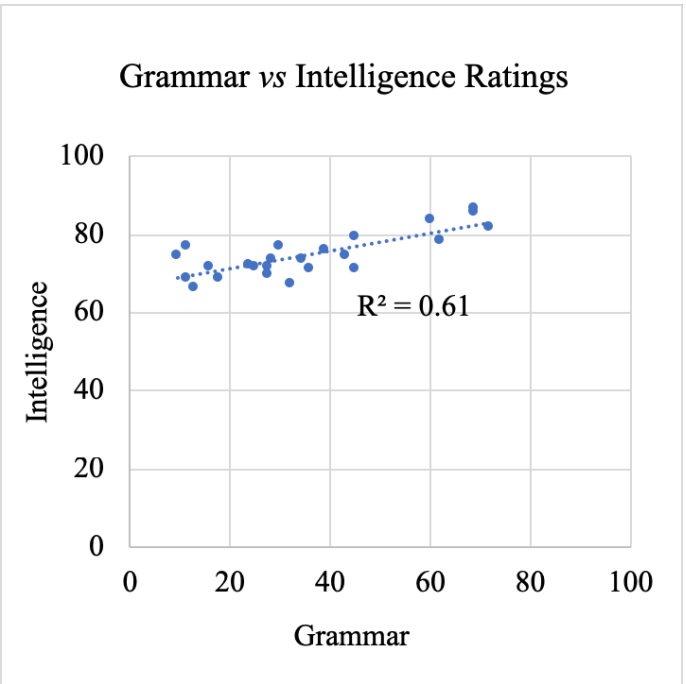

Figure 8. The relationship between grammar ratings and intelligence ratings

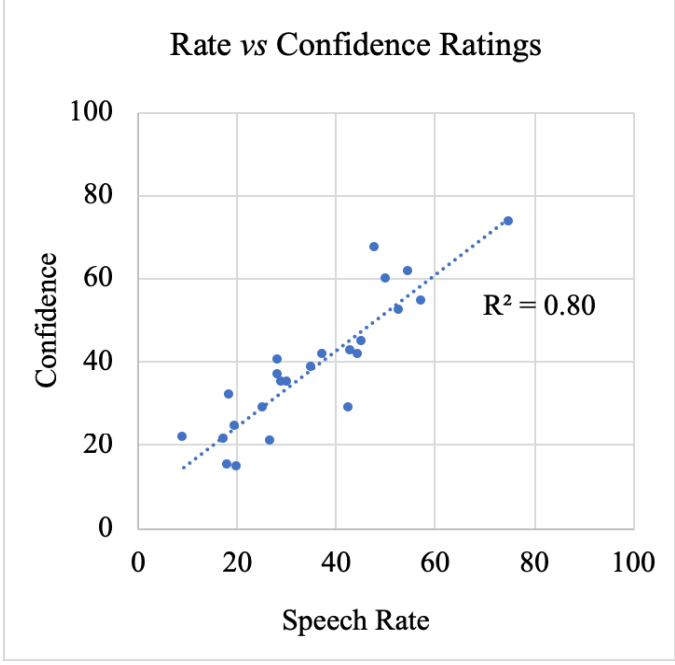

Figure 9. The relationship between rate of speech ratings and confidence ratings

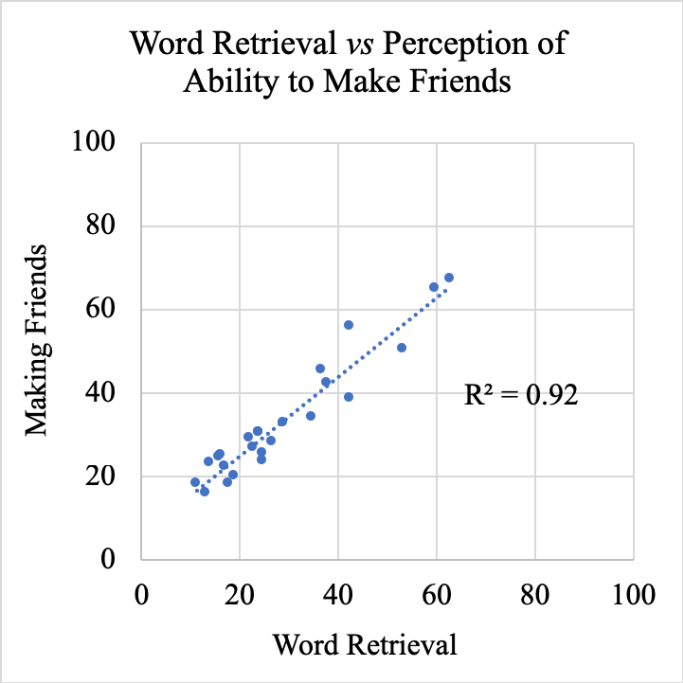

Figure 10. The relationship between word retrieval ratings and the perception of ability to make friends

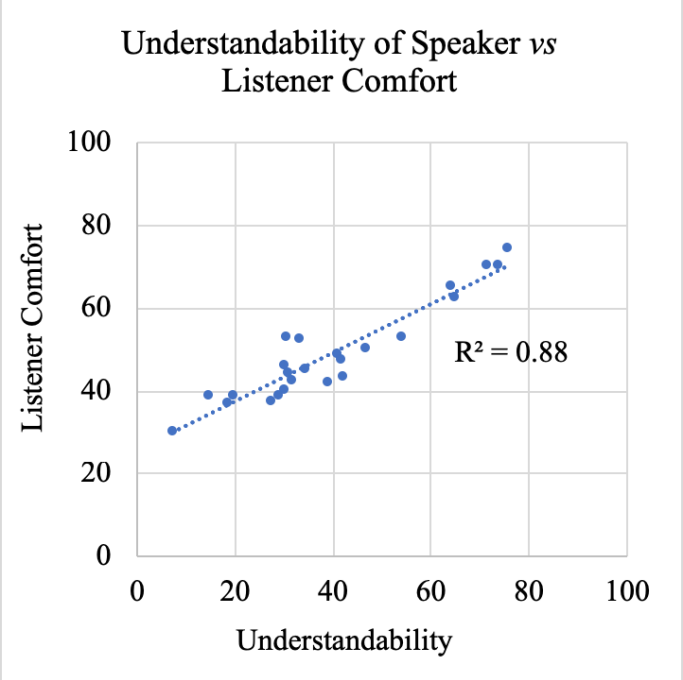

Figure 11. The relationship between understandability ratings and listener comfort ratings

The fluency characteristic that most influenced listener feelings of comfort while listening to the speakers was perceived level of understandability (r = .940), as shown in Figure 11. Listener comfort was also highly influenced by grammar (r = .919), word retrieval (r = .899), and effort (r = .856). Finally, the listener judgment of speakers' need for speech-language therapy was most highly influenced by perception of word retrieval abilities (r = .942) as shown in Figure 12. Recommendation for speech-language therapy was also highly influenced by grammar (r = .902), understandability (r = .888), and effort (r = .874).

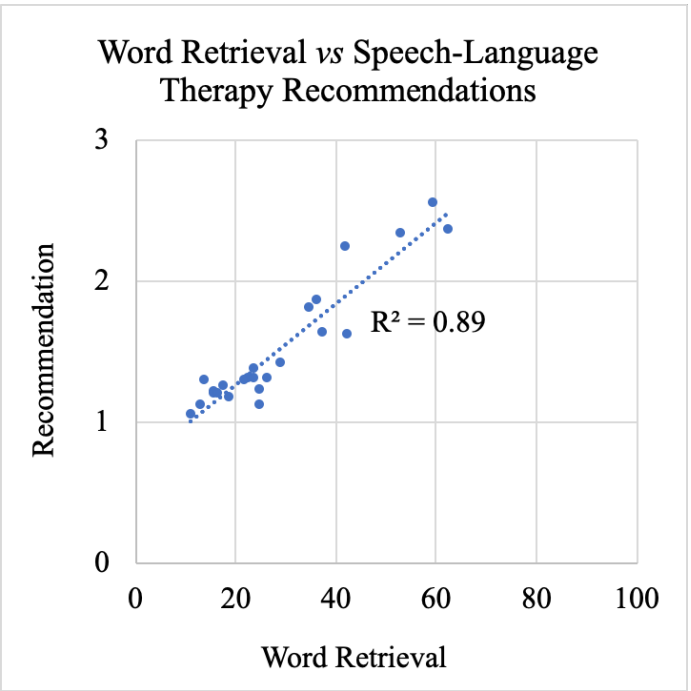

Figure 12. The relationship between word retrieval ratings and recommendations for speech-language therapy

Discussion

We compared undergraduate listener perceptions of fluent and nonfluent PwA based on ratings of speech samples. Listeners were able to discriminate the differences between fluent and nonfluent speech, as demonstrated by significant differences in mean ratings between the two groups on almost all measures of fluency (excluding rate of speech, which approached significance). In addition, listeners perceived the personality characteristics of fluent speakers more favorably than nonfluent speakers as demonstrated by a significant difference in mean ratings between the two groups on all measures of personality. Listeners showed the most hesitance to make judgements on intelligence of speakers compared to all other personality characteristics, regardless of fluency, as demonstrated by the most "unable to judge" responses on intelligence questions.

Although past studies have examined listener perceptions of PwA (e.g. Zraick & Boone, 1991; Croteau & Le Dorze, 2001) and how fluency plays a role in perceptions (e.g. Harmon et al., 2016; Allard & Williams, 2008), this study was the first to have the same participants make judgements on both fluency characteristics and personality characteristics. Through having the listeners rate linguistic measures associated with fluency, we were able to find that listeners could, in fact, discriminate between fluent and nonfluent speech. This finding demonstrates the validity of the ratings, showing that the listeners were appropriately rating the speakers. This finding also demonstrates that fluency is associated with salient speech cues easily recognized by listeners.

These results support findings from past literature that listeners perceive speakers more favorably when their speech is more fluent (Allard & Williams, 2008; Harmon et al., 2016). This trend shown in past literature and reinforced by this study might be due to stereotypes associated

with PwA. Stereotypes about PwA have possibly come about due to the general unfavorable characteristics associated with speech communication difficulties. Since people are used to communicating in a certain way in their everyday lives, implicit biases may arise when confronted with communication partners who fall outside of the norm. People may incorrectly assume things about speaker intelligence or friendliness when they cannot effectively communicate with them. Perceptions about PwA may also be influenced by ageist stereotypes, since a majority of PwA are older adults.

Although the general trend of the findings indicated that listeners make more favorable judgements for more fluent speakers, some listeners showed hesitance in making judgements about intelligence based on the speech they heard, and fluency ratings were less strongly related to intelligence than other personality characteristics. This may have been due to those listeners having some knowledge of aphasia from past classes where they were taught that aphasia does not negatively impact intelligence or cognitive abilities. Further analysis of the data must be completed to see if level of knowledge about aphasia and/or the listeners being speech and hearing sciences majors played a role in intelligence ratings.

The listeners may have rated the nonfluent speakers as having less confidence and lower ability to make friends because they took into account how lowered speech abilities may affect the way the general public perceives PwA. These perceptions are in agreement with literature examining perceptions of confidence and social aspects of PwA that have tied lowered fluency with lower perceptions of confidence and friendliness (Allard & Williams, 2008; Harmon et al., 2016). In addition, it has been shown that PwA do have a harder time making and maintaining social connections (Hilari & Northcott, 2017; Cruice et al., 2006).

Future Directions

More analyses must be completed with the data collected from this experiment. First, the information collected from listeners at the beginning of the survey will be compared to ratings to see if the students' major area of study, their reported knowledge about aphasia, and/or exposure to PwA had an influence on their perceptions. Studies suggest that increased knowledge, combined with experience can reduce the impact of preconceived notions. For example, when comparing undergraduate and graduate students' perceptions of aphasia, Harmon et al. (2016) found that graduate students felt more comfortable listening to the PwA, rated them as more intelligent, and judged their speech to be more intelligible than undergraduate ratings. The authors attributed these differences in perceptions to the greater level of education combined with clinical experiences that graduate students had.

A vast majority of the listeners were speech and hearing sciences majors, which means that they will likely work with PwA and individuals with other fluency disorders in their clinical practice. Because these students have had some coursework about communication disorders, including aphasia, their ratings may reflect this knowledge. If this study were repeated with undergraduate students who had no previous knowledge of aphasia, the undergraduate speech and hearing sciences majors would most likely have higher overall ratings. Since public awareness of aphasia is so low, the ratings from the undergraduate speech and hearing sciences majors would also probably be higher than if the listeners for this experiment were pooled to reflect the general public. Undergraduate students of different majors or the general public might also have fewer "unable to judge" responses on intelligence ratings, as listeners without background knowledge of aphasia would not know that aphasia does not impact cognitive abilities. Therefore, they would likely show less hesitance making judgements about intelligence

based on the speech samples and follow the general trend that equates lowered fluency with lower intelligence.

However, the listeners in this study still rated the nonfluent speakers less favorably than the fluent speakers on personality characteristics, including intelligence. In addition, they rated themselves to be less comfortable when listening to the nonfluent speakers. This shows that undergraduate speech and hearing sciences students could benefit from a greater emphasis being placed on educating students about fluency disorders and how they do not change people's personality characteristics or impact cognitive abilities. Graduate coursework should build on this in order to prepare students to be the most effective and unbiased clinicians as possible.

Along with a more comprehensive education that better trains future SLPs, an increase in positive interactions between SLP students and PwA may help reduce the discomfort shown by students when listening to nonfluent speech and help reduce stereotypes. Harmon et al. (2016) speculated that graduate students rated the intelligibility of PwA more highly than the undergraduate students since they learned strategies in their clinical experiences to better understand less fluent speech. This higher level of understandability was likely responsible for the higher listener comfort levels, as past studies have shown that how well the listener understands a speaker plays a large role in how comfortable the listener is (Lasker & Beukelman, 1999).

Purves, Petersen, and Puurveen (2013) showed how impactful an aphasia mentoring program between SLP graduate students and PwA could be for both the students and PwA. By increasing their interactions and allowing the students to get to know the PwA as people outside of a clinical setting, SLP graduate students say they gained a very deep understanding of aphasia and were able to make strong connections with the PwA. These experiences should be much

more widely implemented so that more students (and PwA) can benefit from positive interactions with a stereotyped group, which is known to minimize future application of stereotypes (Brewer & Miller, 1984).

The indication that fluency is strongly linked to broader perceptions of speakers demonstrates the need for a uniform, standard way to measure fluency. A uniform measure of fluency would help with more efficient fluency targets in the clinic setting, helping patients increase their fluency to minimize the social and emotional impact that perceptions of lowered fluency has on individuals. In addition, a standard measure of fluency would help in research settings, so that experiments may more readily be compared to each other. As it stands, different researchers have different definitions for fluency and how to measure it in their experiments, which makes it difficult to compare results across studies.

Limitations

There are several limitations to the current study. A possible limitation for the correlational data is that some ratings may have had an influence on the others. We reduced the impact of this by using a very conservative r value to report significant findings. Possible effects from question order on the questionnaire as well as drift effects from speaker order were also minimized by random order of questions and speakers throughout the experiment. However, this still could have affected our findings.

Another limitation, as discussed above, is that our sample consisted mostly of speech and hearing sciences undergraduate students. This group is not representative of the general population in terms of familiarity with and knowledge about aphasia. None of the listeners in this study responded, “I have never heard of it,” or, “I have heard of it, but I don’t know what it is,” when asked how much they know about aphasia. This is a large contrast from the general United

States public where only 10.3% of people have heard of aphasia and just 1.5% of people have some knowledge about the disorder (Simmons-Mackie et al., 2002). In addition, our sample included a higher percentage of women (89%) than the general public. Finally, a majority of our listeners (95%) were between the ages of 18- and 23-years-old, which is much lower than the general public would reflect.

Conclusions

Students rated fluent speakers more favorably across all speech and personality characteristics analyzed in this study, indicating that fluency plays an important role in how listeners perceive speakers. Students responded "unable to judge" most often for perception of intelligence, indicating that some students felt as though intelligence cannot be measured by speech alone. However, a majority of students still made judgements on speaker intelligence and it followed the overall trend of fluent speakers being judged more favorably, indicating that most listeners felt comfortable equating intelligence to speech ability. Many of the characteristics analyzed are highly intercorrelated and influence judgements of one another, indicating that listener perceptions are based on a combination of fluency and speech characteristics. A uniform measure for fluency will allow clinicians to create better therapy targets for their clients. More effective treatment for aphasia and other fluency disorders will lessen the negative social impacts faced due to less fluent speech. In addition, undergraduate SLP students could benefit from more education focusing on reduction of stereotypes associated with aphasia and other fluency disorders. Finally, opportunities for positive interactions to occur between SLP students (graduate and/or undergraduate) and PwA should be highly encouraged and more widely available.

References

Allard, E. R., & Williams, D. F., (2008). Listeners' perceptions of speech and language disorders. *Journal of Communication Disorders*, 41(2), 108-123.

Antonucci, T. C., & Akiyama, H. (1987). Social networks in adult life and a preliminary examination of the convoy model. *Journal of Gerontology*, 42(5), 519-527.

Kertesz, A. (1982). *The Western Aphasia Battery.* New York: Grune & Stratton.

ASHA. (n.d.) Aphasia: Overview. Retrieved from https://www.asha.org/Practice-Portal/Clinical-Topics/Aphasia/

Brewer, M.B., & Miller, N. (1984). Beyond the contact hypothesis: Theoretical perspectives on desegregation. In N. Miller & M.B. Brewer (Eds.), *Groups in Contact: The Psychology of Desegregation* (pp. 281-302). Orlando, FL: Academic Press.

Croteau, C., & Le Dorze, G. (2001). Spouses' perceptions of persons with aphasia. *Aphasiology*,15, 811–825.

Cruice, M. (2001). *Communication and quality of life in older people with aphasia and healthy older people.* Unpublished doctoral dissertation completed within Department of Speech Pathology and Audiology, University of Queensland, Australia.

Cruice, M., Worrall, L., Hickson, L., & Murison, R. (2003). Finding a focus for quality of life with aphasia: Social and emotional health, and psychological well-being. *Aphasiology*, 17(4), 333-353.

Cruice, M., Worrall, L., & Hickson, L. (2006). Quantifying aphasic people's social lives in the context of non-aphasic peers. *Aphasiology*, 20(12), 1210-1225.

Feyereisen, P., Verbeke-Dewitte, C., & Seron, X. (1986). On fluency measures in aphasic speech. *Journal of Clinical and Experimental Neuropsychology*, 8(4), 393-404.

Goodglass, H., Christiansen, J. A., & Gallagher, R. E. (1993). Comparison of morphology and syntax in free narrative and structured tests: Fluent vs. nonfluent aphasics. *Cortex*, 29, 377-407.

Goodglass, H., & Kaplan, E. (1983). *The Assessment of Aphasia and Related Disorders*. Philadelphia: Lea & Febiger.

Goodglass, H., Quadfasel, F. A., & Timberlake, W. H. (1964). Phrase length and type and severity of aphasia. *Cortex*, 1, 133-153.

Gordon, J. K. (1998). The fluency dimension in aphasia. Aphasiology, 12(7), 673-688.

Gough, H. G., & Heilbrun, A. B. (1983). *The Adjective Check List manual*. Palo Alto, CA: Consulting Psychologists Press.

Harmon, T.G., Jacks, A., Haley, K. L., & Faldowski, R. A. (2016). Listener perceptions of simulated fluent speech in nonfluent aphasia. *Aphasiology*, 30(8), 922-942.

Hilari, K., & Northcott, S. (2017). Struggling to stay connected: Comparing the social relationships of healthy older people and people with stroke and aphasia. *Aphasiology,* 31(6), 674-687.

Howes, D. (1964). Application of the word-frequency concept to aphasia. In A. V. S. DeReuck & M. O'Connor (Eds.), *Disorders of Language* (pp. 47-48). London, Eng: J.A. Churchill.

Lasker, J., & Beukelman, D., R. (1999). Peer's perceptions of storytelling by an adult with aphasia. *Aphasiology*, 13(9-11), 857-869.

MacWhinney, B., Fromm, D., Forbes, M. & Holland, A. (2011). AphasiaBank: Methods for studying discourse. *Aphasiology, 25,*1286-1307.

Marshall, R. C., & Tompkins, C. A. (1982). Verbal self-correction behaviors of fluent and nonfluent aphasic subjects. *Brain and Language*, 15, 292-306.

National Aphasia Association (n.d.). Aphasia Definitions. Retrieved from https://www.aphasia.org/aphasia-definitions/

Northcott, S., & Hilari, K. (2013). Stroke Social Network Scale: Development and psychometric evaluation of a new patient-reported measure. *Clinical Rehabilitation*, 27, 823-833.

Park, H., Rogalski, Y., Rodriguez, A., Zlatar, Z., Benjamin, M., Harnish, S., Bennett, J., Rosenbek, J., Crosson, B., & Reilly, J. (2011). Perceptual cues used by listeners to discriminate fluency from nonfluent narrative discourse. *Aphasiology*, 25(9), 998-1015.

Parr, S. (2001). Psychosocial aspects of aphasia: Whose perspectives? *Folia Phoniatrica et Logopaedica,* 53, 266–288.

Parr, S., & Byng, S. (1997). *Talking about aphasia: Living with the loss of language after stroke.* Buckingham: Open University Press (OUP).

Purves, B. A., Petersen, J., & Puurveen, G. (2013). An aphasia mentoring program: Perspectives of speech-language pathology students and of mentors with aphasia. *American Journal of Speech-Language Pathology*, 22, 370-379.

Sherbourne, C. D., & Stewart, A. L. (1991). The MOS social support survey. *Social Science & Medicine*, 32, 705-714.

Simmons-Mackie, N. (2018). Aphasia in North America. Retrieved from http://www.aphasiaaccess.org/white-paper

Simmons-Mackie, N., Code, C., Armstrong, E., Stiegler, L. & Elman, R. (2002). What is aphasia? An international survey of public awareness of aphasia. *Aphasiology, 16,* 837-848.

Thompson, S. C., Sobolew-Shubin, A., Graham, M. A., & Janigian, A. S. (1989). Psychosocial adjustment following a stroke. *Social Science & Medicine*, 28(3), 239-247.

Zraick, R. I., & Boone, D. R. (1991). Spouse attitudes toward the person with aphasia. *Journal of Speech Language and Hearing Research*, 34, 123-12.