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Does Choral Singing Improve Word Finding? A single-subject examination of the effects of  
choir participation for Primary Progressive Aphasia.

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### Abstract

The purpose of this study was to provide quantitative evidence that choir participation can help individuals with aphasia make significant gains in functional communication.

The participant in this study was a member of the Bridges Choir who presented with primary progressive aphasia. Language samples were collected from the participant immediately before and after each of the once-weekly rehearsals over an eight-week period and analyzed for changes in word-finding and verbal fluency. The participant was also interviewed at the end of the eight-week session to measure qualitative changes in her language, cognition, and/or affect.

Contrary to expectations, analysis of the participant's language samples revealed no significant changes in word-finding immediately following each choir rehearsal, although verbal fluency showed a statistically insignificant trend of improvement. Interestingly, the participant herself stated that it was "easier to find words" after rehearsals, although quantitative data did not support this statement. The participant's interview expressed positive, qualitative results related to choir participation, consistent with extant literature. Future research recommendations include examining data from more choir participants, eliciting longer speech samples, and adding within-subject control conditions to account for possible activity-related fatigue.

Does Choral Singing Improve Word Finding? A single-subject examination of the effects of choir participation for Primary Progressive Aphasia.

## **Introduction**

### *Aphasia and Primary Progressive Aphasia*

Aphasia is an acquired, neurogenic disorder that prevents the brain's access to language, resulting in deficits in expression, comprehension, reading, writing, or any combination of these modalities. These difficulties can be caused by a stroke or by focal damage to the brain's left hemisphere, such as in cases of injuries or tumors (Corsten, Konradi, Schimpf, Hardering, & Keilmann, 2014). Aphasia can also be caused by the insidious degeneration of language areas in the brain, as seen in cases of primary progressive aphasia (PPA).

PPA is a degenerative, neurological disease that results in the gradual, progressive loss of language and communication in the absence of cognitive or memory deficits and is characterized by difficulties in word-finding and spelling, as well as abnormalities in speech patterns. (Mahendra, 2012; Mesulam, 2003). Manifestations of PPA can be further divided into three subtypes, which can all be differentiated by the extent of an individual's difficulties with conceptual information, syntax, and phonological memory (Hoffman, Ahmad Sajjadi, Patterson, & Nestor, 2017).

The language deficits brought on by aphasia not only result in communication difficulties, but also bring about negative psychosocial effects. Individuals with aphasia often experience frustration from not being able to accurately express their thoughts (Leichty & Braun, 2006). Social isolation and reduced social participation are also common among individuals with aphasia (Tarrant et al., 2016; Zumbansen et al., 2016). Further, depression can arise from both the constant frustration and the struggle to communicate with others (Leichty & Brain, 2006).

*Aphasia, Music, and Choir*

The potential psychosocial harms associated with aphasia highlight the importance of providing support for individuals affected by the disorder. A means of support could be to involve individuals with aphasia in activities they find meaningful. J. Leichty, an individual who had been living with aphasia for 30 years, testified to the positive contributions of engaging in meaningful activities as part of his coping process in an essay (Leichty & Braun, 2006). He explained that participating in an activity that enabled him to work through a difficult task and produce a positive product added to his sense of well-being (Leichty & Braun, 2006). Likewise, Mesulam (2003) explained that individuals with aphasia, particularly those with PPA, continue to cultivate their interests in their complex hobbies, such as gardening, sculpting and painting, in the face of their disorders.

In his essay, Leichty (2006) mentioned music as an activity he found meaningful, and even, therapeutic. Interestingly, music has caught the attention of researchers in the study of aphasia and other cognitive-communicative disorders, due to a large evidence base that demonstrates the contributions of music to the health and sense of well-being of individuals affected by these disorders. Whereas language heavily depends on left hemisphere processes, music actively engages both sides of the brain, possibly explaining the preserved music abilities of people with aphasia (Fogg-Rogers et al., 2015). Moreover, researchers have speculated that music could encourage the reorganization of the brain's functions, such as language, to non-lesioned areas of the brain (da Fontoura, de Carvalho Rodrigues, Brandao, Moncao, & de Salles, 2014). The hypothesis that music can activate spared language areas in the right hemisphere of the brain is the basis for a commonly-used type of aphasia therapy called Melodic Intonation Therapy (MIT). While there remains a need for more research on the efficacy of MIT, single-case studies have

shown improvements in the verbal expression of participants who underwent treatment (da Fontoura et al., 2014).

Additionally, singing in a group can augment the benefits of music while mitigating possible risk for social isolation among individuals with aphasia. Choirs provide individuals with a supportive environment and opportunities for social stimulation (Zumbansen et al., 2016). Studies regarding choral participation among individuals with aphasia have demonstrated not only changes in functional communication, but also in mood, confidence, and social engagement (Tamplin et al., 2013; Zumbansen et al., 2016).

#### *Bridges Choir at Northern Illinois University*

Studies on the communicative and psychological benefits of choir for people with aphasia inspired the creation of a choir in the DeKalb area specifically designed for the population. The Bridges Choir, named because music can serve as a bridge between cognition, language, and communication (Lanza, unpublished thesis), is modeled after existing aphasia choirs (Tamplin et al., 2013; Zumbansen et al., 2016). The choir is comprised of approximately 10 individuals residing in the DeKalb area and living with aphasia or other neurogenic, cognitive-communicative disorders (e.g., dementia). The once-per-week, 90-minute choir rehearsals are led by speech-language pathology graduate students under the supervision of a faculty member.

In order to provide support to choir members, the speech-language pathology graduate students are partnered with members of the Bridges Choir in order to assist them with individual needs such as turning pages, relaying instructions, or modeling vocal warm-ups. The choir also employs the use of multi-modal forms of communication (Murray & Clark, 2015) through the use of individual lyric binders, a whiteboard for illustrating concepts and themes related to the

music, as well as an overhead projector to display the lyrics on a screen in order for the choir members to maximize their participation and accessibility to language during choir rehearsals.

### *Hypotheses*

Despite previous studies suggesting the benefits of choral singing for individuals with aphasia, very few studies on the topic exist; and these studies focus on describing the qualitative changes that arise from choral participation (Sole, Mercadel-Brotons, Gallego, & Riera, 2010). The current study examined one member of the Bridges Choir who presented with PPA, in order to provide quantitative evidence that choral participation can help individuals with aphasia to make significant gains in functional communication. Given the current literature on aphasia, music, and choir, the following three hypotheses were proposed:

1. Choral singing will lead to increased word finding across three discourse genres (procedural, episodic, narrative) as indexed by changes in the participant's measures of Correct Information Units (CIUs), Percent Noun Retrieval (%WR), and % Substantive Verbs (%SV) measures in language samples following each rehearsal. Such findings would be consistent with MIT studies that found an increase in participants' correct information produced during spontaneous speech as well as in naming tasks. This finding could be possibly explained by the previously-mentioned idea that music can encourage the rewiring of the brain and activate right hemisphere language areas (da Fontoura et al., 2014).
2. Choral singing will lead to increased verbal fluency across the three discourse genres named above, as indexed by changes in the participant's Words per Minute (WPM) and Percent Disfluencies (%DF) measures from language samples following each rehearsal.

In addition to word finding, an increase in words per minute was observed in studies of participants who underwent MIT, possibly based on the same idea from above (da Fontoura et al., 2014). Similarly, Brotons & Kroger (2000) found increased verbal fluency among individuals with dementia following passive listening to music, which is likely explained by short-term memory activation during the listening process, which in turn, improves word recall and verbal expression.

3. Choral singing will lead to positive qualitative changes in language, cognition, and affect as indexed by a final interview at the conclusion of the choir sessions. Positive changes related to choral participation have been found in individuals with aphasia, who have previously reported increased social participation, mood, and functional communication (Zumbansen et al., 2016).

## **Methods**

### *Participant*

The participant in this study, TL (initials changed), was drawn from a pool of individuals who are members of the Bridges Choir. TL is a retired professor with a Ph.D. in social work. She was living independently at the time of this study. She reported having problems with her language during the summer of 2016; However, because she had no other abnormalities in her fluency of speaking, grammar, or auditory comprehension, she was diagnosed with mild anomic aphasia, or an inability to recall the names of everyday objects (Mesulam, 2003). She referred herself to the university clinic during the fall of 2017 and was sent to a neurologist for a magnetic resonance imaging (MRI) scan. Her MRI scan was deemed “unremarkable,”



suggesting an insidious nature to her language deficits that could not be explained by a visual inspection of her results.

TL's anomia continued to progress, and she started to receive speech-language therapy once per week to develop compensatory strategies for her word-finding difficulties. During the summer of 2018, she reported experiencing additional cognitive symptoms, including memory problems and hallucinations.

Three standardized tests (Western Aphasia Battery-R, the Boston Naming Test, Rivermead Behavioral Memory Test) were administered to TL three times over a period of one year (2017-2018). The Western Aphasia Battery-R measures the presence, type, and severity of aphasia, the Boston Naming Test measures age-normed naming abilities, and the Rivermead Behavioral Memory Test measures different types of memory (e.g., verbal versus non-verbal, learning versus retention) and provides an overall memory composite score normed by age. Her scores indicated a clinically significant, progressive decline in her ability to name objects, as well as in her memory (see Table 1).

TABLE 1: TL's Standardized Test Results

	<b>Initial evaluation (9/2017)</b>	<b>Pre-choir (7/2018)</b>	<b>Post-choir (12/2018)</b>
<b>Western Aphasia Battery-R</b>	19/20 Spontaneous Speech 10/10 Auditory Comprehension 9.8/10 Repetition 8.7/10 Naming and Word Finding AQ = 95, Mild	N/A	IP
<b>Boston Naming Test – 2<sup>nd</sup> Ed. (X = 48.9, SD = 6.3)</b>	42/60	38/60	32/60
<b>Rivermead Behavioral Memory Test – 3<sup>rd</sup> Ed. (X = 100, SD = 15)</b>	N/A	General Memory Index = 80 (9 <sup>th</sup> %ile)	General Memory Index = 70 (2 <sup>nd</sup> %ile)

TL's symptoms were consistent with the logopenic variant (lv-PPA) subtype of PPA. Lv-PPA is characterized by a reduced verbal output, a slower speech rate, simple grammatical

structures, and frequent word-finding difficulties. Impairments in auditory comprehension, repetition ability, reading, and spelling can also be observed. Finally, lv-PPA is the most anatomically-related subtype of PPA to Alzheimer's Disease, among all three PPA subtypes (Mahendra, 2012). Despite the progressive nature of the disease, some degree of improvement in naming abilities among individuals with PPA can still be achieved through intensive lexical retrieval training (Henry & Beeson, 2008).

### *Data Collection*

#### *Language Samples*

In order to collect quantitative data for this study, each prompt to elicit language, across each of three discourse genres, was piloted on two to three healthy individuals between the ages of 55-80 years old. Individual prompts were approved for use in the study if they elicited at least an average of 45 seconds of language from control participants without additional cueing. Prompt questions that did not meet this criterion were discarded and replaced with new prompts that were piloted in a similar manner. Then, a protocol for collecting language samples five minutes prior to and immediately after choral singing was incorporated into each once-weekly Bridges Choir rehearsal, for a period of eight weeks. An example of the protocol is found in Appendix A. For each language sample collection, the participant was asked three questions representing each of the three different discourse genres (see below for a description of the different genres used). Each question was asked verbally, accompanied by a printed version of the prompt in order to maximize comprehension and memory. An example of the printed prompts can be seen in Appendix B. The participant's responses were audio recorded for later transcription and analysis. Each language sample was later transcribed orthographically.

The three discourse genres elicited by the prompts included procedural, episodic, and narrative genres. Each of these genres was included based on previous research which has shown differences in language variables (e.g., word retrieval, syntactic complexity) for both healthy adults and those with aphasia, depending on the genre (Hallowell, 2017). The procedural prompt required the participant to describe the steps to a common task, the episodic prompt required the participant to relay a particular memory, and the narrative prompt required the participant to look at a picture and tell a story based off of the picture. Each of the three different genres varied in their use of short-term or long-term recall, the specificity of the instructions, and the relevance to the participant's past, all of which could affect the participant's response and, subsequently, the data that result from the analysis of her response (Hallowell, 2017). Therefore, the use of three different genres to elicit responses from the participant allowed for a more comprehensive and accurate analysis of her language.

#### *Post-Session Interview*

In addition to the quantitative data collected from the participant during every rehearsal, an exit interview was conducted with her at the end of the eight-week session. The questions from this interview focused on the thoughts and feelings of the participant regarding the social environment of the choir as well as her perceived communicative and psychosocial benefits from choir participation (Lanza, unpublished thesis). The interview questions used are found in Appendix C. The participant's answers were analyzed to determine whether she saw any qualitative changes in her language, cognition, affect during the duration of the session.

*Data Analysis**Language Samples*

To quantitatively measure any changes in word-finding and fluency that occurred between the beginning and the end of each choir rehearsal across the three different genres, five different discourse analysis measures were used on each orthographically-transcribed language sample: Correct Information Units (CIUs), Percent Noun Retrieval (%WR), Percent Substantive Verb Retrieval (%SV), Words per Minute (WPM), and Percent Disfluencies (%DF).

In order to detect changes in the participant's word-finding, the CIU, %WR and %SV measures of the participant were calculated per sample. CIU's are used to determine the relevance, informativeness, and correctness of the information provided by the participant in her prompts (Nicholas & Brookshire, 1993). To calculate the CIU, units of information provided by the participant in her language sample were tallied based on her adherence to, accuracy of, and elaboration in the prompt given to them. These units of information were then divided by the time (in minutes) in which the participant had spoken in order to calculate the amount of CIU's the participant had per minute of speech.

Meanwhile, the %WR measure was used to assess the efficiency with which the participant retrieved nouns in discourse (Mayer & Murray, 2003). This measure was calculated by counting the number of nouns the participant used correctly on the first attempt and dividing it by the total number of correct and incorrect attempts the participant made in retrieving nouns. A third measure, %SV, was used to determine the specificity (substantive) or the generality (light) of the verbs used by the participant (Mayer & Murray, 2003). Light verbs are generic verbs such as go, have, and do that can be replaced by more accurate verbs depending on the context of their use (Breedin, Saffran, & Schwartz 1998). For the purpose of consistency, eight

verbs (go, have, do, come, give, get, make, take) from Breedin et al.'s (1998) list were considered "light" in this study. The rest of the verbs were counted as substantive. The number of substantive verbs in each language sample were counted and then divided by the total number of action verbs used by the participant to find the %SV measure. Altogether, the CIU's per minute, %WR, and %SV give holistic information on the participant's ability to efficiently retrieve words as well as the degree of specificity in the participant's choice of words.

To determine changes in the participant's fluency, the participant's speaking rate as well as her number of disfluencies per language sample were calculated. The first measure, WPM, calculated the number of words used by the participant divided by the total time it took for the participant to complete the prompt (Nicholas & Brookshire, 1993). A second measure, the disfluency rate, was calculated by counting the participant's number of disfluencies (i.e., silent or filled pauses, false starts, sound distortions, and repetitions) and dividing it by the total number of words she used in the language sample (Karpathio, Kambanros, Potaminaou, Papatrianfyllou, & Sakka, 2018). These two measures reveal information regarding the participant's ease of speaking during the language sample collection.

In order to determine whether any changes between the pre-choir and post-choir language sample data were statistically significant, the Tau-U score for each pair of language samples was obtained using a tau-calculator on [singecaseresearch.org](http://singecaseresearch.org). Tau-U is an index used to analyze single-participant data that compares sets of data to determine effect sizes, while controlling for a trend in the baseline data (Parker, Vannest, Davis, & Sauber et al., 2011). The Tau-U scores generated from the calculator were accompanied by p values that indicated the statistical significance of the measures collected between each pair of language sample data.

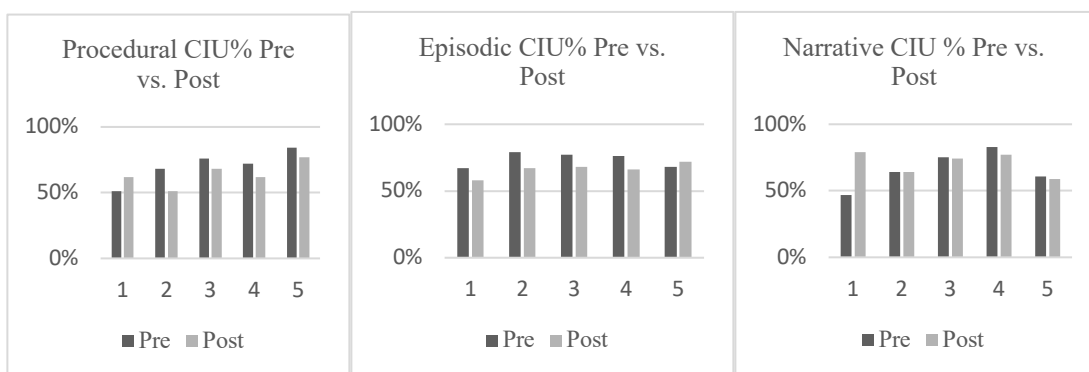
## Results

Data collection during the eight-week choir session resulted in five different pairs of procedural, episodic, and narrative language samples. The three missing pairs of pre-post choir data resulted from participant absence from rehearsals during three different weeks within the choir session.

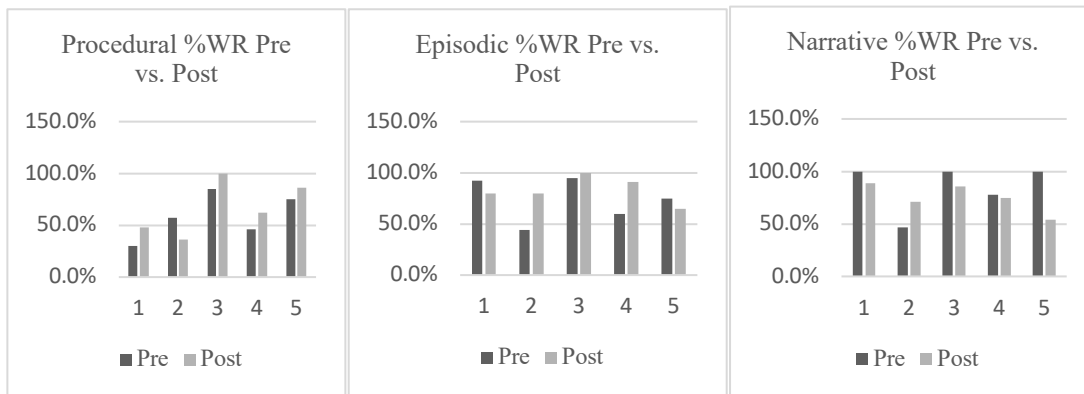
### *Word Finding*

Visual inspection of the three word-finding measures, namely CIU's, %WR, and %SV, revealed no pattern of improvement between pre-choir and post-choir data (see Graphs 1-3). Similarly, Tau-U calculations resulted in effect sizes as follows:  $-0.045$ ,  $-0.01$ , and  $0.13$ , indicating inconsistent and minimal changes, if at all, for each measure of discourse analyses (see Table 2). Aside from the CIU measure ( $p=0.04$ ), the respective  $p$ -values for these effect sizes were statistically insignificant ( $-0.06$ , and  $0.55$ ). The mixed results from the 3 different discourse analysis measures did not support the original hypothesis that choir participation results in increased word finding.

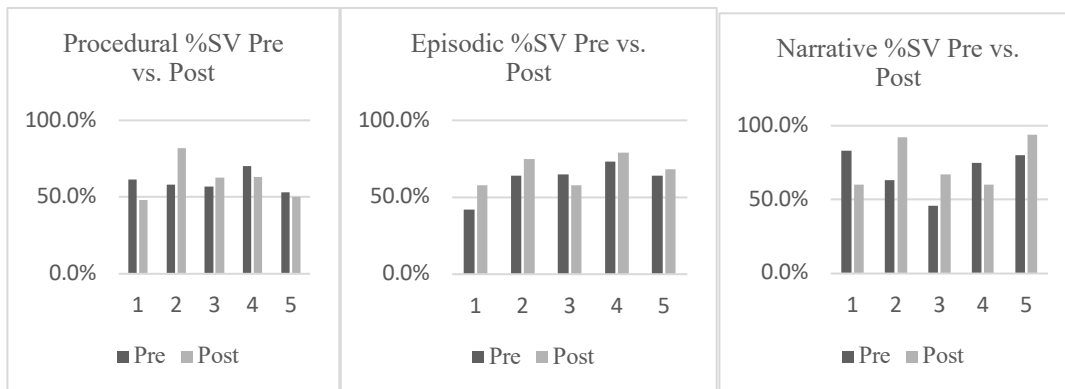
GRAPH 1: Correct Information Units



GRAPH 2: % Noun Retrieval



GRAPH 3: %Substantive Verbs

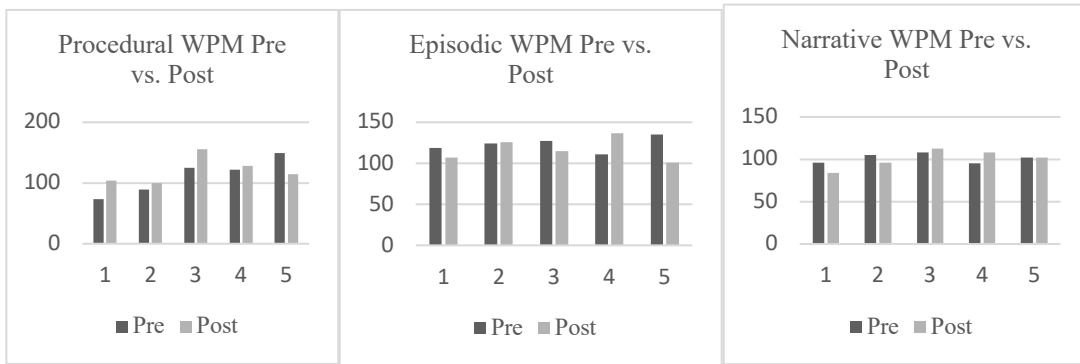


### *Verbal Fluency*

Tau-U calculations of the verbal fluency measures, WPM, and %DF, indicated effect sizes of -0.16 and 0.07, respectively, again demonstrating very minimal changes. However, while visual inspection of WPM data indicated an inconsistent pattern from pre-to-post choir across the five weeks of samples, %DF decreased consistently during the same period (see Graph 4-5). The p-value for the respective measures were 0.47 and 0.76, indicating statistical insignificance.

Despite statistical insignificance, the results for verbal disfluency were somewhat consistent with the original hypothesis that choir participation results in increased verbal fluency.

GRAPH 4: Words Per Minute



GRAPH 5: % Disfluencies

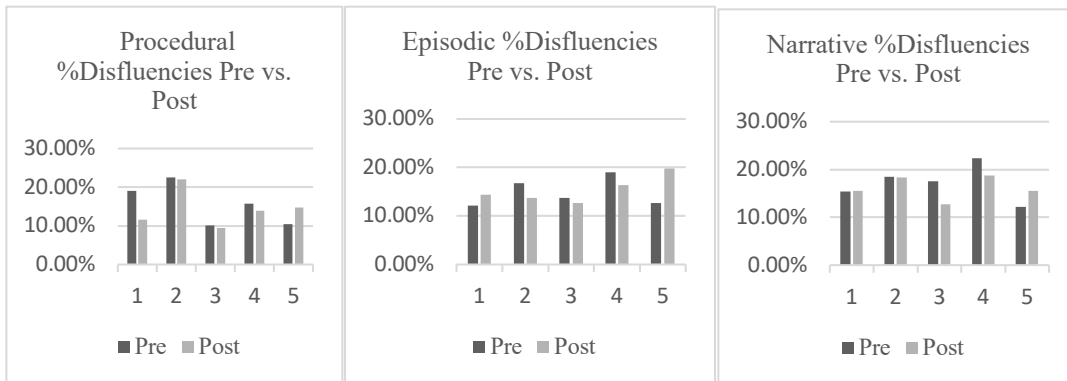


TABLE 2: Tau-U Calculations

Variable	Tau-U Weighted Average	p value
CIU	-0.4533	0.0403
WPM	-0.16	0.4693
CPM	-0.2933	0.1846
%WR	-0.0133	-0.0603
%SV	0.1333	0.5465
%DF	0.0667	0.763



*Interview Answers*

TL's final interview was analyzed for themes related to qualitative changes in language, cognition, or affect that resulted from choir participation. During the interview, she reported, "I was amazed when I got home that I could talk...without having to stop and...find a word." Moreover, she indicated that choir allowed her to pursue her interests in singing, provided her with camaraderie, and that she could not think of a reason why someone would not want to join choir. TL's responses aligned with the third hypothesis of the study, suggesting that choral participation resulted in positive qualitative changes in participant language, cognition, and affect.

**Discussion***Word Finding*

The inconsistent results from the CIU, %WR, %SV measures in this study indicate that there is currently no evidence that choir participation leads to an immediate increase in word finding. These results are contrary to the expectations of this study based on previous literature regarding the efficacy of MIT in improving the verbal expression of individuals with aphasia. One possible explanation could be that MIT is designed to pair specific words to specific melodies, and that simultaneous learning facilitates access to the trained words due to their association with music (da Fontoura et al., 2014). Meanwhile, choral participation does not target specific words for learning during rehearsals.

Similarly, other known treatments for aphasia such as semantic feature analysis (SFA) train individuals with aphasia to recognize the conceptual features of individual target words and teach clients particular strategies in helping generate characteristics of a particular word to ease its retrieval (Boyle, 2010). The efficacy of MIT and SFA as aphasia treatments suggests that

while music may be hypothesized to aid in the reorganization of language in spared regions in the brain, specific training on word retrieval remains a necessary component in increasing the particular skill of word finding for individuals with aphasia, which is not necessarily present in less-structured choir rehearsals.

The small, but statistically-significant negative effect size of CIUs also needs to be addressed. While the data appear to show a decrease in CIUs as a direct result of choir participation, extraneous factors may also explain the participant's lower CIU values from pre-to-post choir sessions. During the data collection period, the participant reported experiencing hallucinatory symptoms and increased frustration as a result of her progressing PPA, possibly affecting the length and quality of her responses. Additionally, some of the prompts related to recalling emotionally-significant memories. Hallowell (2017) indicated that mood, interests, and the participant's psychological state could all be factors causing variability among discourse. These psychological and emotional factors experienced by TL during this period may have played a role in contributing to the length and quality of her responses.

### *Verbal Fluency*

Similarly to the Tau-U calculations of the word-finding measures above, measures related to a change in fluency in the participant's speech immediately after choir rehearsals indicated minimal effect sizes. However, it is important to note that while the raw data (participant's WPM) revealed no consistent pattern of change, the participant's %DF consistently declined immediately after choir rehearsals, although with statistical insignificance ( $p=0.76$ ). The consistent decline of %DF indicate that TL consistently produced less disfluencies, such as pauses and false starts, throughout her speech immediately after choir participation. These

findings indicate that choir participation could lead to increased verbal fluency, although more research should be done on this topic to confirm a possible statistically significant relationship between these variables.

Interestingly, the participant's WPM did not increase as predicted in the hypothesis, which was derived from an MIT study that saw an increase in the WPM of a participant after music-related treatment (da Fontoura et al., 2014). Regardless, the preliminary finding of increased verbal fluency in this study was consistent with the literature describing the relationship between singing and aphasia, as well as in singing and dementia (Brotons & Kroger, 2000).

#### *Interview Answers*

TL reported positive feelings associated with the Bridges Choir related to her communication and social participation. In her interview, she indicated having stable communication since joining the choir and forming friendships with other members of the group. Her reported feelings of communication confidence, a sense of belonging, and engagement in recreational activities are all consistent with the existing literature on choral participation in individuals with aphasia (Tamplin et al., 2013; Zumbansen et al., 2016).

Despite the quantitative results, the participant's interview indicated that there is value in existing choirs designed specifically for people with aphasia or other cognitive-communicative disorders. Although the quantitative results in this study indicated no statistically-significant improvements in the participant's functional communication, the participant herself reported feeling a sense of improvement in her psychosocial well-being as well as self-efficacy in communicating. These results indicated that choral participation may not be adequate to replace traditional speech-language therapy for individuals with aphasia but may still be helpful in

improving the communication confidence of individuals with aphasia and perhaps prime their brains to embrace empirically-based speech-language treatment that can significantly improve their functional communication.

### *Future Recommendations*

More studies should be done in order to determine the efficacy of choral participation in eliciting statistically-significant gains in functional communication for individuals with aphasia. Based off of the results of this study, recommendations can be made in order to help guide future research on this topic. First, future studies should examine data from more participants who have varying causes of aphasia or varying cognitive-communicative disorders. The participant in this study presented with PPA, and while studies have shown that word retrieval outcomes for individuals with PPA and stroke-induced aphasia could be comparable after intensive treatment (Henry & Beeson, 2008), there may be characteristics unique to other types of aphasia that can affect individual response to choir participation. Having a larger sample of participants would help contribute to a better understanding on the effects of choral participation on the population of individuals with aphasia and those with other cognitive-communicative disorders.

Second, future studies should aim to elicit longer speech samples from participants. Hallowell (2017) recommends using between 300 to 400 words to ensure the reliability of discourse analysis methods over time. Although each session of language sample collections in this study consisted of about 300 to 350 words, this was due to the combined responses from all three prompts/genres. One way Hallowell's recommended word count could be achieved is to focus on developing one to two prompts of particular discourse genres that could elicit language for a period longer than 45 seconds.

Finally, future studies should look for ways to control for activity-related fatigue that could impact the performance of participants during post-choir language sample collections. Bridges Choir rehearsals lasted 90 minutes each, with one 10-minute social break built into the sessions. Methods of mitigating possible reduced performance during the second language collection should be explored to ensure that changes in functional communication immediately after choir are due to choral participation itself, rather than any fatigue related to activity participation.

### **Conclusion**

In summary, music has been found to have communicative and psychological benefits for individuals with aphasia, as evidenced by MIT single-case studies and descriptive research on aphasia choirs (da Fontoura et al., 2014; Tarrant et al., 2016; Zumbansen et al., 2016). Preliminary evidence of the effects of choral participation for a participant with PPA demonstrated a trend towards a (statistically insignificant) quantitative increase in verbal fluency as indexed by changes in %DF, and a qualitative increase in social engagement and mood as identified in the participant's final interview. This is consistent with previously mentioned literature. No quantitative changes were found in the word retrieval of the participant, contrary to the first hypothesis of this study. This study supports the notion that choral singing may augment the benefits of, but cannot replace, traditional forms of speech therapy for individuals with PPA. It is likely that specific training in semantic and phonological features, as seen in MIT and SFA, are necessary for creating specific functional gains in communication for this population (Boyle, 2010; da Fontoura et al., 2014). Despite the lack of quantitative evidence for the effects of choir participation on functional communication, there is value in choirs designated specifically for

this population. This study demonstrates the ability of choir participation to enhance the well-being of individuals with aphasia by increasing their communication confidence and by providing them with opportunities for social engagement in a supportive environment.

## References

- Boyle, M. (2010). Semantic feature analysis treatment for aphasic word retrieval impairments: What's in a name? *Topics in Stroke Rehabilitation, 17*(6), 411-422.
- Breedin, S.D., Saffran, E.M., & Schwartz, M.F. (1998). Semantic factors in verb retrieval: An effect of complexity. *Brain and Language, 63*, 1-31.
- Brotons, M. & Koger, S.M. (2000). The impact of music therapy on language functioning in dementia. *Journal of Music Therapy, 37*(3), 183-195.
- Corsten, S., Konradi, J., Schimpf, E., Hardering, F., & Keilmann, A. (2014). Improving quality of life in aphasia – evidence for the effectiveness of the biographic-narrative approach. *Aphasiology, 28*(4), 440-452.
- da Fontoura, D.R., de Carvalho Rodrigues, J., Brandao, L., Moncao, A.M., & de Salles, J.F. (2014). Efficacy of the adapted melodic intonation therapy: A case study of Broca's aphasia patient. *Revista Disturbios de Comunicacao, 26*, 641-655.
- Fogg-Rogers, L., Buetow, S., Talmage, A., McCann, C., Leao, S., Tippett, L., Leung, J., McPherson, K., & Purdy, S. (2015). Choral singing therapy following stroke or parkinson's disease an exploration of participant's experiences. *Disability and Rehabilitation, 38*(10), 952-962.
- Hallowell, B. (2017). *Aphasia and other acquired neurogenic language disorders: A guide for clinical excellence*. San Diego, CA: Plural Publishing.
- Henry, M.L. & Beeson, P.M. (2008). Treatment for lexical retrieval in progressive aphasia. *Aphasiology, 22*(7-8), 826-838.
- Hoffman, P., Ahmad Sajjadi, S.A., Patterson, K., & Nestor, P.J. (2017). Data-driven classification of patients with primary progressive aphasia. *Brain and Language, 174*, 86-93.
- Karpathiou, Kamranos, Potamianou, Papatriantafyllou, & Sakka. (2008). Quantitative connected speech analysis in a case of nonfluent/agrammatic primary progressive aphasia. *Special Issue on Neuropsychology, Athens, Greece*.
- Lanza, B. Extending the bridge: Examining the effectiveness of choral singing in aphasia. Unpublished manuscript, Northern Illinois University.
- Liechty, J.A., & Braun, M.E. (2006). Loss and hope: Strategies for coping with aphasia. *Topics in Stroke Rehabilitation, 13*(3), 84-86.
- Mayer, J.F., & Murray, L.L. Functional measures of naming in aphasia: Word retrieval in confrontation naming versus connected speech. *Aphasiology, 17*(5), 481-497.

- Mesulam, M-M. (2003). Primary progressive aphasia—A language-based dementia. *The New England Journal of Medicine*, 394, 1535-1542.
- Mahendra, N. (2012). The logopenic variant of primary progressive aphasia: Effects on linguistic communication. *ASHA Wire*, 17(2), 50-59.
- Murray, L., & Clark, H. (2015). *Neurogenic Disorders of Language and Cognition: evidence-based clinical practice 2<sup>nd</sup> ed.* Austin, Tx: Pro-Ed.
- Nicholas, L. & Brookshire, R. (1993). A system for quantifying the informativeness and efficiency of connected speech of adults with aphasia. *Journal of Speech and Hearing Research*, 36, 338-350.
- Parker, R.I., Vannest, K.J., Davis, J.L., Sauber, S.B. (2010). Combining non-overlap and trend for single case research: Tau-U. *Behavior Therapy*. 42, 284–299. DOI: 10.1016/j.beth.2010.08.006.
- Sole, C., Mercadel-Brotons, M., Gallego, S., Riera, M. (2010). Contributions of music to aging adults' quality of life. *Journal of Music Therapy*, 47(3), 264-281.
- Tarrant, M., Warmoth, K., Code, C., Dean, S., Goodwin, V.A., Stein, K., & Sugavanam, T. (2016). Creating psychological connections between intervention recipients: Development and focus group evaluation of a group singing session for people with aphasia. *BMJ Open* 2016;6:e009652. doi: 10.1136/bmjopen-2015-009652
- Zumbansen, A., Peretz, I., Anglade, C., Bilodeau, S., Michelyne, G., Hubert, M., Hebert, S. (2016). Effect of choir activity in the rehabilitation of aphasia: a blind, randomized, controlled pilot study. *Aphasiology*, 31(8), 879-900 DOI: 10.1090/02687038.2016.1227424.



## Appendix A—Language Sample Collection Protocol

Fall 2018

Bridges Choir – Language sample data collection

November 5, 2018

### Objective

Each choir participant will ideally complete a language sample (about 60 seconds) for each of 3 genres:

1. Narrative (e.g., “Tell me about your favorite movie”)
2. Episodic (e.g., “Tell me how you make coffee”)
3. Narrative (from picture cards)

### Pre-Choir Questions

Before choir rehearsals, each choir participant will be asked 1 set of questions from each genre for a total of 3 questions. The collection of language samples should take 60-90 seconds at the most per question. Only one prompt can be given to the participant per question (e.g. “can you tell me more?”).

**\*\*Procedural prompt and picture stimulus have specific instructions. See below.**

#### Procedural Prompt

- Instructions: Start the recording device and place the printed prompt in front of the participant. Read the prompt out loud. Then, say, “Tell this to me as if I have never done this before.”
- Tell me how you would go about making a sand castle.

#### Episodic Prompt

- Tell me about the strangest thing you have come across.

#### Picture Stimulus/ Narrative Prompt (1)

- Instructions: Start the recording device and place the picture stimulus in front of the participant. Then, say, “Tell me a story about this picture with a beginning, middle, and end.”

### Post-Choir Questions

During the social break, each choir participant will be asked another set of questions comprised of 1 question per genre. The collection of language samples should take 60-90 seconds at the most per question. Only one prompt can be given to the participant per question (e.g. “can you tell me more?”).

**\*\*Procedural prompt and picture stimulus have specific instructions. See below.**

#### Procedural Prompt

- Instructions: Start the recording device and place the printed prompt in front of the participant. Read the prompt out loud. Then, say, “Tell this to me as if I have never done this before.”

- Tell me how you would go about playing hide-and-seek.

Episodic Prompt

- Tell me about a time when a small gesture from a stranger made a big impact on you.

Picture Stimulus/ Narrative Prompt (1)

- Instructions: Start the recording device and place the picture stimulus in front of the participant. Then, say, “Tell me a story about this picture with a beginning, middle, and end.”

## Appendix B— Language Sample Pre-Post Procedural and Episodic Prompts

Tell me how you would go about making a sand castle.

Tell me about the strangest thing you have come across.

Tell me how you would go about playing hide-and-seek.

Tell me about a time when a small gesture from a stranger made a big impact on you.

Appendix C—Final Interview Questions  
(from Lanza, unpublished thesis)

1. How are you today – can you tell me about yourself and your health?
2. How much does aphasia affect your every day life?
3. How would you describe aphasia to someone else?
4. Why did you decide to join the choir?
5. What did you like about the choir? Is there anything you would change?
6. Why do you think someone with aphasia would not want to join choir?
7. Did you make any new friends during your time in choir?
8. What was your favorite song that the choir sang?
9. Do you participate in other activities outside of choir?
10. Do you think your communication has changed at all since you joined the choir?