2025-06-03

Comparing Emotional Facial Expressions Produced During Personal Narrative Discourse by People With and Without Aphasia

Chloe K. Houghton
Brigham Young University

Comparing Emotional Facial Expressions Produced

During Personal Narrative Discourse by People

With and Without Aphasia

Chloe K. Houghton

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

Master of Science

Tyson G. Harmon, Chair
Shawn L. Nissen
Garrett Cardon

Department of Communication Disorders

Brigham Young University

ABSTRACT

Comparing Emotional Facial Expressions Produced
During Personal Narrative Discourse by People
With and Without Aphasia

Chloe K. Houghton
Department of Communication Disorders, BYU
Master of Science

This study investigated the differences in emotional facial expressivity between people with aphasia (PWA) and control participants during emotional discourse tasks. Participants consisted of 26 PWA and 26 control participants from Aphasia Talk Bank who retold a stroke or illness story and an important life event story, totaling 104 video files. Undergraduate research assistants were trained to code emotional facial expressions according to valence, intensity, and duration utilizing a modified Facial Expression Coding System (FACES; Kring & Sloan, 1991). Dependent variables included positive frequency, negative frequency, positive intensity, and negative intensity. Results from this study demonstrate that female participants used more positive facial expressions compared to men. For intensity, female PWA participants produce less intense positive facial expressions compared to female control participants and control participants produce more negatively intense facial expressions compared to PWA participants. Lastly, no correlation was found between severity of aphasia and emotional facial expressivity. These findings suggest that PWA allocate a larger amount of attentional energy towards language production, resulting in less intense positive and negative facial expressions.

Keywords: aphasia, emotional facial expressions, facial coding

ACKNOWLEDGMENTS

I want to express my gratitude towards all who have guided me and supported me through this entire thesis process. First, I would like to thank my thesis chair, Dr. Harmon, for the amazing hands-on opportunities granted from participating in this research project. Mentorship throughout the completion of this thesis has been critical to my learning and success. Additionally, I would like to thank Dr. Nissen and Dr. Cardon for serving on my thesis committee.

Data collection would not have been possible without funding through a McKay School of Education’s Experiential Learning Grant. Likewise, I would like to express my gratitude to all the undergraduate research assistants I have worked alongside during this project including Anna Norman, Macall Walker, Marin Li, Audrey Saunders, and Leila Moore.

Lastly, I would also like to thank my family and my husband, Levi, for the unconditional love and support they have shown me. I am grateful for my parent’s example of hard work, perseverance, and never shying away from a challenge. I am also incredibly grateful for my husband, his unwavering encouragement, and for being my rock throughout graduate school.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DESCRIPTION OF THESIS STRUCTURE AND CONTENT

This thesis, *Comparing Emotional Facial Expressions Produced During Personal Narrative Discourse by People With and Without Aphasia*, is written in a hybrid format which combines traditional thesis requirements with journal publication formats. The preliminary pages of the thesis reflect requirements for submission to the university. The remainder of this thesis report is arranged as a journal article, conforming to length and style requirements for submitting research to relevant education journals within the field of communication disorders. The annotated bibliography is included in Appendix A. The International Review Board Approval Letter is included in Appendix B. The Facial Expression Coding System is included in Appendix C. The Modified Facial Expression Coding System is included in Appendix D. The Facial Coding Checklist is included in Appendix E.

Introduction

Emotion is experienced in varying degrees and defined and interpreted in multiple ways. Emotion, described as "a complex response pattern that is experienced subjectively and most often accompanied by physiological and behavioral changes" (American Psychological Association, n.d., Emotion section), is also a critical aspect of day-to-day communication. Whether recounting a fun family vacation to Hawaii or describing the heartache of losing a loved one, emotion and language are interconnected. Researchers have investigated how emotion is processed in adults, but more is still needed to understand how it is potentially disrupted in disordered populations, such as those with aphasia.

Aphasia is an acquired language disorder commonly caused by stroke, traumatic brain injury, or neurodegenerative disease. People with aphasia (PWA) exhibit language difficulties in areas such as word retrieval, comprehension, repetition, reading, writing, and conversational fluency. These language difficulties manifest across varying levels of severity that can impact not only their communication, but also their ability to connect with others. Similar to how an aphasia diagnosis has an individualized impact on a person, it is important for clinicians to understand the individualized emotional responses of PWA (Harmon, 2024). However, little is known about how different facets of emotion are affected for PWA, and even less is known about emotional facial expressivity in aphasia and its impact on overall communication.

Emotional expression, as a whole, can be difficult to quantify due to its abstract nature. When dealing with objective measures of emotion, researchers have divided this construct into two different subcomponents: valence and arousal/intensity. Valence indicates whether the emotion or stimulus is considered negative (i.e., sadness), neutral (i.e., chair), or positive (i.e., smile). Arousal and intensity both relate to the ability to activate or draw out an emotion. In other words, valence describes the direction of the emotion whereas intensity describes the strength of the emotion. Both are important for quantifying emotional expression (Warriner et al., 2013).

Emotion Subtypes for Individuals With and Without Aphasia

Researchers have investigated different aspects of emotion by conceptualizing emotional expression through words, gestures, prosody, and facial expressions. Given the focus of the present study on people with aphasia, we focus our review of literature on how each of these channels of emotional expression may be impacted by aphasia. One channel in which emotion can be expressed is through words. For both PWA and neurotypical adults, emotional content may interfere with word-naming. Studies by Harmon et al. (2022, 2023) and Blackett et al. (2017, 2024) suggest that a difference in valence (i.e., negative or positive) can result in slower response times and decreased naming accuracy. For PWA specifically, negatively-valenced words interfere with lexical retrieval—resulting in longer response times and decreased accuracy (Blackett et al., 2024; Harmon et al., 2022). Findings related to positively-valenced words have been more varied and inconclusive. Harmon et al. (2022) found no statistical difference in response time or accuracy for positively-valenced words, while Blackett et al. (2024) found that positively-valenced words created longer response times and lower accuracy for PWA, with a smaller interference effect compared to the negative stimuli. Overall, emotionally-valenced words, specifically negatively-valenced words, create longer retrieval times for PWA and neurologically healthy adults alike, indicating an interaction between emotion and lexical production.

A second channel in which emotion can be expressed is through prosody. Affective prosody refers to paralinguistic aspects of speech such as pitch (i.e., fundamental frequency), pause, stress, tone, etc. that help to convey emotion (Leung et al., 2017). Although the right hemisphere has been identified as a predominant center for emotional processing, the literature reveals that left-hemisphere damage resulting in aphasia can cause prosodic deficits as well. Leung et al. (2017) found that participants with more severe aphasia were less likely to correctly identify *and* produce affective prosody. Additionally, the emotional intensity was correlated to the production of certain emotions (i.e., surprise and disinterest) for people with severe aphasia. These researchers hypothesized that participants with more severe aphasia "direct[ed] a large proportion of their cognitive activity towards speech production rather than prosody production" known as the "distraction defect" (Leung et al., 2017). Although not specifically investigating affective prosody, Walker et al. (2009) discussed how the "distraction defect" could potentially impact the linguistic prosodic element of pause for PWA. In a study comparing control participants with left and right hemisphere damage participants during various sentence production tasks, participants with left-hemisphere damage produced longer pauses compared to the control group (Baum et al., 2001). Word-finding deficits are characteristic for PWA, potentially impacting the proportion of cognitive and attentional activity devoted to language production during these sentence production tasks, which subsequently impacts pause length.

Gestures are another form of non-verbal communication that can portray emotion. Research has investigated how an aphasia diagnosis impacts the ability to produce gestures and how often they are utilized in communication opportunities. One finding suggests that different types of aphasia may not only impact the ability to produce gestures, but also the frequency of gesture use (Feyereisen & Seron, 1982). Specifically, non-fluent aphasia types may lead to hemiparesis of limbs, impacting ability to produce gestures bilaterally. In a single observational case study by Feyereisen and Seron (1982), a Wernicke's aphasia participant produced a higher number of gestures in a given amount of time. A Broca's aphasia participant, on the other hand, produced a higher number of gestures per word spoken. These findings suggest that participants with fluent and non-fluent aphasia subtypes may be compensating for their verbal deficits in different ways.

A fourth channel for emotional expression is facial expressions. People's ability to perceive and produce emotional facial expressions has been studied across various populations (Blonder et al., 1993; Borod, 1993; Borod et al., 1986, 1988; Collignon et al., 2008; Fischer & LaFrance, 2015; Lorch et al., 1998). Similar to gestures, facial expressions are a form of non-verbal communication. It has been suggested that due to deficits in verbal communication (e.g., words, prosody, etc.), PWA are less impaired in the non-verbal forms of communication, such as facial expressions (Feyereisen & Seron, 1982).

Undoubtedly, each one of the aforementioned channels of emotional expressivity is important and all interact in complex ways during day-to-day human communication. Determining an individual's emotional state requires all facets of expressed emotion (e.g., auditory information through words and prosody as well as visual information through gestures and facial expressions). This may be particularly important for the communication partners of people with aphasia who are relying on information beyond lexical production to make inferences about their emotional state. Collignon et al. (2008) found that people were better at determining the type of emotion that was elicited during an experiment when bimodal sensory systems were activated (i.e., audio-visual integration). Additionally, if emotional auditory and visual stimuli did not match, partners relied more on the visual stimuli to determine an elicited emotion. As such, we can conclude that facial expressions specifically, are integral in determining emotion during communication opportunities and should be investigated more thoroughly.

Theories of Processing Emotional Facial Expressions

The brain plays an important role in processing emotional facial expressions and there are different hypotheses that intend to explain this process. Currently, two different models aim to explain which areas of the brain specialize in emotional facial expression. The right hemisphere hypothesis argues that producing emotional facial expressions is a right hemisphere dominant ability, regardless of valence (i.e., positive facial expressions or negative facial expressions; see Borod, 1993). The valence hypothesis, on the other hand, argues that the right hemisphere is specialized for negative facial expressions and the left-hemisphere is specialized for positive facial expressions (Borod, 1993). Although neither hypothesis has been investigated thoroughly enough for strong conclusions to be reached, PWA have been found to have intact abilities to produce appropriate emotional facial expressions, especially compared to individuals with right hemisphere damage (Blonder et al., 1993; Borod, 1993; Borod et al., 1986, 1988; Lorch et al., 1998).

Groups That Differ in Perceiving and/or Producing Emotional Facial Expressions

Differences in perceiving and/or expressing emotional facial expressions have been shown between several populations. For example, males and females have been shown to differ in their emotional facial expressivity. Specifically, females tend to demonstrate greater expressivity through crying and smiling more and producing more intense facial expressions overall (Fischer & LaFrance, 2015). The differences in emotional facial expressions between males and females is just one of multiple examples. Because of the objective of the present study, however, we focus below on emotional facial expressions in brain damaged populations.

Like men compared with women, people with right hemisphere damage have been compared to people without brain damage in relation to their ability to perceive and produce emotional facial expressions. In the literature, many researchers have been interested in investigating emotional facial expressions, specifically for people with right hemisphere damage. Overall, it has been found that individuals with right hemisphere damage demonstrate deficits in the frequency and accuracy of facial expressions produced compared to control groups (Blonder et al., 1993; Borod, 1993; Borod et al., 1986, 1988; Lorch et al., 1998). Specifically, multiple studies have focused on the difference in posed (e.g., participant is asked to elicit a specific emotional facial expression representing "sadness") versus spontaneous contexts (i.e., recording participant's facial expressivity while reacting to positive and negative picture scene slides) rather than naturalistic settings (e.g., narrative retells; see Borod, 1993; Borod et al., 1986, 1988).

Participants in the Borod et al. (1986, 1988) studies were tasked to look at negative and positive picture slides in both posed and spontaneous conditions. In the spontaneous condition, the participant's face was video recorded while reacting to picture scenes for 10 positive slides (e.g., a baby picking a flower) and six negative slides (e.g., surgical procedure) for 20 seconds. Participants were then asked how they felt. In the posed condition, participants were tasked with producing a facial expression that exhibited the following emotions: happiness, pleasant surprise, sexual arousal, sadness, anger, fear, disgust, and confusion. For example, the examiner asked participants to "look happy." Human raters reviewed participants' individual facial expression video for each spontaneous and posed stimulus. These human raters coded the following: responsivity (0 = no, 1 = yes), appropriateness (0 = no, 1 = yes), and intensity (7-point Likert scale from "minimal" to "maximal"). Overall, the findings concluded that individuals with right hemisphere damage (RHD) exhibited less appropriate positive facial expressions and had difficulty *producing* posed positive expressions and *perceiving* negative emotions compared to the control group (Borod et al., 1986, 1988). However, there were no significant differences in intensity between the two groups (Borod et al., 1988). Taken together, previous research generally shows that specific populations, such as individuals with right hemisphere damage or males, potentially demonstrate less frequent and intense emotional facial expressivity.

PWA Perceiving and Producing Facial Expressions

Now that we have laid the framework for the literature surrounding subtypes of emotion, how facial expressivity differs among various groups, and hemisphere specialization for facial expressions, what research has been conducted regarding emotional facial expressions for PWA? PWA have been included in many of the aforementioned facial expressivity studies (Blonder et al., 1993; Borod, 1993; Borod et al., 1986, 1988; Lorch et al., 1998). However, sample sizes have been small (i.e., ranging from 7–15 participants with aphasia). Furthermore, methods have varied across studies and PWA are generally combined with control groups in analyses to contrast results from a right hemisphere brain damaged group. As such, we do not fully understand how facial expressivity is impacted in discourse for individuals with aphasia.

The little we do know about facial expressions in PWA surrounds descriptive statistics about posed facial expressions, spontaneous facial expressions, and intensity compared to control groups. For posed facial expressions, PWA appear to produce less accurate posed negative facial expressions compared to neurotypical adults (mean accuracy of .59 for PWA and .79 for controls; Borod et al., 1986). For spontaneous facial expressions during discourse, PWA produced a higher number of laughs on average (9.05 for PWA and 4.67 for controls) but a lower number of smiles on average (24.38 for PWA and 30.62 for controls) compared to the control group (Blonder et al., 1993). Thus, it is possible that PWA produce more positive facial expressions compared to negative facial expressions. In the Borod et al. (1988) article, the mean intensity for PWA on a 7-point Likert scale was 3.62 (0.65 SD) compared to 3.19 (0.56 SD) for controls. Even the right hemisphere damage group had a higher mean intensity (3.38) compared to the controls, inferring the possibility that PWA might produce more intense facial expressions overall compared to neurotypical adults. However, without more statistical power for these variables and a more detailed method for coding facial expressions, these hypotheses are inconclusive.

PWA Producing Emotional Facial Expressions During Discourse

While the studies mentioned above investigated facial expressivity in posed and spontaneous conditions for PWA, only one study that we know of has investigated the production of emotional facial expressions of PWA during discourse (Blonder et al., 1993). Seven males with aphasia were asked to answer various emotional discourse prompts (i.e., “the effects of their illness on mood and communication,” “the importance of religion in your life,” etc.) in their homes. Participants’ responses were videotaped and segmented into 10-second clips. Three female raters were trained to identify the participants’ facial expressivity for each 10-second segment according to a 7-point Likert scale (i.e., 1 = absent to 7 = extreme laughs, cries, or fearful yells). The researchers found that participants with right hemisphere damage (seven males) exhibited less facial expressivity overall compared to the PWA and control groups. Specifically, participants with right hemisphere damage exhibited less positive facial affect (i.e., smiling and laughing) compared to the control group, but demonstrated similar frequency of crying compared to the other groups.

Purpose of Study

Previous research indicates that PWA have spared non-verbal communication, which includes the capacity to produce posed and spontaneous emotional facial expressions in isolation and during discourse (Blonder et al., 1993; Borod, 1993; Borod et al., 1986, 1988; Lorch et al., 1998). As such, it is possible that PWA utilize emotional facial expressions to compensate for their verbal language deficits in order to convey emotion. However, we do not fully understand how PWA utilize the frequency and intensity of facial expressions in communication, and even less in how they utilize facial expressions in narrative discourse. Thus, the purpose of the present study is to investigate how the frequency and intensity of facial expressions differ between people with and without aphasia during narrative discourse.

The first question we aim to address is whether PWA exhibit more facial expressions than adults who do not have aphasia during personal narrative discourse. We hypothesize that PWA will use more emotional facial expressions to compensate for varying language deficits. The second question we aim to address is whether emotional facial expressions produced by PWA are perceived as more arousing than those produced by adults who do not have aphasia during personal narrative discourse. We hypothesize that emotional facial expressions exhibited by PWA will be perceived as more arousing because of diminished emotional expression through verbal language. Another possibility is that facial expressions will not be perceived as more emotionally arousing because the attention of PWA will be allocated towards verbal production. The third question we aim to address is whether the severity of language impairment for PWA relates to the quantity and intensity of emotional facial expressions during personal narrative discourse. We hypothesize that more severe language impairments will lead to more facial expressions and more arousing facial expressions.

Method

The present study used a group experimental design to investigate emotional facial expressions produced during discourse production by adults with and without aphasia. Study procedures were approved by Brigham Young University’s Institutional Review Board in March 2023 (IRB#: IRB2023-082).

Participants

Audiovisual samples from 52 participants were used in the present study. This included 26 PWA and 26 control participants who were randomly selected from AphasiaBank, a database containing protocoled videos of PWA and control individuals. Among other tasks, each AphasiaBank participant completed two narrative discourse tasks, which were likely to contain emotional content—the story of their stroke/injury and the story of an important life event. The process for determining which samples were included in the present study included randomly selecting and ordering participants and checking narrative discourse samples for the following exclusionary criteria: (a) video quality insufficient for visualizing facial expressions due to low pixelation; (b) glasses glare; (c) hands covering part of the face; (d) quality of lighting was insufficient to clearly visualize all facial structures; (e) part of the face was not visible due to angle of the camera; (f) video less than 1 minute; (i) video did not contain one of the two emotional discourse prompts; and (j) significant facial groping interfering with natural facial expression. If either sample for a participant was excluded, the associated participant was excluded. This process continued until 26 PWA and 26 control participants were added.

The average age of PWA was 61 years and the average age of control participants was 62 years. A two-way ANOVA that included group (PWA vs. control) and sex (male vs. female) factors showed no statistical difference for age (p-value < .0001).

Participants with aphasia included 26 adults (13 female, 13 males). AphasiaBank includes demographic data for each individual, including Western Aphasia Battery–Revised (WAB-R) scores obtained at the time of sample recording (Kertez, 2007). Classification of aphasia types included anomic (11 participants), conduction (8 participants), Broca's (3 participants), Wernicke's (1 participant), transcortical sensory (1 participant), transcortical motor (1 participant), and non-aphasic by WAB (1 participant). Severity ranged from non-aphasic according to the WAB-R to severe according to the following breakdown: non-aphasic (1 participant), mild (12 participants), moderate (11 participants), and severe (2 participants). Average years of education was 16. Each participant in AphasiaBank told two personal narratives that were considered likely to contain some emotional content: the story of an injury and the story of an important life event. Table 1 summarizes demographic information for each participant group.

Table 1

Demographic Information

Neurologic Status	Sex	N	Age *M(SD)*	Age Range	Education *M(SD)*	Education Range	Race/ Ethnicity	WAB-R AQ *M(SD)*	WAB-R AQ Range	WAB-R Types	WAB-R Severity	WAB-R Fluency *M(SD)*	WAB-R Fluency Range	WAB-R Naming *M(SD)*	WAB-R Naming Range
Aphasia	Male	13	61(14)	30-84	17(3)	12-22	12 WH, 1 HL	70.86 (17.06)	36.8-90.4	4 Anomic 1 Wernicke 6 Conduction 2 Broca	5 mild 6 moderate 2 severe	14.54 (3.14)	9-19	6.82 (2.76)	0.2-9.3
	Female	13	61(11)	46-90	15(2)	12-18	12 WH, 1 AA	79.61 (11.62)	64.5-95.0	7 Anomic 2 Conduction 1 Broca 1 TransSensory 1 TransMotor 1 NABW	1 NABW 6 mild 6 moderate	16.08 (2.58)	11-19	7.26 (2.23)	2.6-9.3
Control	Male	13	61(19)	31-86	16(3)	12-21	13 WH	/	/	/	/	/	/	/	/
	Female	13	62(14)	41-87	16(3)	12-20	13 WH	/	/	/	/	/	/	/	/

Note. WH = White, HL = Hispanic/Latino, AA = African-American, AQ = Aphasia Quotient, TransSensory = Transcortical Sensory, TransMotor = Transcortical Motor, NABW = Non-aphasic by WAB-R, Education = years of education.

Procedures

As mentioned previously, video samples from the AphasiaBank stroke/injury story and important life event story were analyzed for the present study. Emotional facial expressions were analyzed using a structured coding process that was based on the Facial Expression Coding System (FACES; Kring & Sloan, 1991, 2007). The FACES protocol is designed for human coders to identify facial expressions according to valence (positive/negative), intensity (Likert scale of 1–4), and duration (time start until time end; Kring & Sloan, 1991). The original FACES protocol was intended for coding facial expressions of participants who were performing an observation task (i.e., not talking). Our modified protocol was designed to apply this coding system to emotional facial expressions produced during discourse tasks. Specifically, modifications included operationalizing what constituted different intensity levels of emotional facial expression and adding “pensive” under positive affect descriptors when determining valence.

Using the modified FACES protocol, a team of two female undergraduate research assistants were trained as emotional facial expression coders for this project. The research assistants were allowed to start data analysis when they received at least 80% reliability in two out of the three coding criteria and at least 70% on one of the three coding criteria. During their training process, the research assistants had to reach a certain level of reliability through pass-off files before beginning data analysis. The research assistants first coded a pass-off file in which they coded a participant to their best ability. Next, research assistants were tasked with secondary coding the file, essentially cross-checking their work to see if they still agreed with their previous codes. After completing secondary coding, research assistants’ codes were matched to the team leads codes. The pass-off criteria looked at (a) interval accuracy (percent number of matched codes compared to master coding), (b) valence accuracy (percentage matched valence), and (c) intensity correlation (statistical *r* analysis for directionality of intensity compared to master code). Once these criteria were met, the research assistants began coding the data files.

Coders viewed the video clips through a 27-inch (2560 x 1440) Apple computer, a Dell S2421NX 24-inch (1920 x 1080) display, a Dell U2410 24-inch (1920 x 1200) display, a 15-inch MacBook Pro, or a Dell U2715H 27-inch (2560-1440) display. Coders opened the videos through VLC media player (www.videolan.org) and utilized the time extension to code duration up to the millisecond. Coders viewed muted videos in a quiet environment to eliminate confounding emotional stimuli in the background that could bias their coding. If possible, coders were asked to use sound cancelling headphones and were allowed to turn on white noise to eliminate distractions.

First, coders watched a minimum of 30 seconds of the video clip before coding to determine the baseline face of the participant. While creating the modified FACES protocol, we found that each individual may have, for example, a more positive facial expression, resting sad face, or have their eyebrows permanently elevated compared to the last individual. As such, determining a participant's "neutral" face helped reduce bias in coding facial expressions. Once coders were calibrated to the participant's baseline facial expression, they coded for 20 minutes before taking a mandatory 5-minute break. After the break, coders watch 30 seconds of the video again before coding for another 20 minutes. The cycle repeated for however long their coding session took place (typically about an hour).

The de-identified data files were randomly ordered and assigned to coders who were blind to the neurological status of the participant and which narrative discourse task they were producing.

Dependent Variables

This study examined the frequency and intensity of both positive and negative facial expressions exhibited during emotional discourse. Frequency of positively and negatively valenced facial expressions were counted and then divided by sample time to normalize across samples. Average intensity per sample was measured by averaging all positive and negative valance ratings per sample.

Reliability

To obtain inter-rater and intra-rater reliability, at least 10% of samples were recoded within and across undergraduate coders. Inter-rater and intra-rater reliability results were obtained across four variables (positive frequency, negative frequency, positive intensity, and negative intensity) using Pearson's *r*.

Inter-rater reliability ranged from $r = .634$ (for negative intensity) to $r = .986$ (for negative frequency). Intra-rater reliability for coder MW ranged from $r = .655$ (for negative intensity) to $r = .978$ (for positive frequency). Intra-rater reliability for coder ML ranged from $r = .704$ (for positive intensity) to $r = .904$ (for positive frequency). Table 2 details all the reliability results.

Table 2

Inter-Rater and Intra-Rater Reliability Results

Reliability	Frequency		Intensity	
	Positive	Negative	Positive	Negative
Inter-rater	0.766	0.986	0.896	0.634
Intra-rater (MW)	0.978	0.965	0.772	0.655
Intra-rater (ML)	0.904	0.867	0.704	0.774

Note. Frequency = total number of facial expressions divided by sample time. Intensity = average intensity per sample.

Data Analysis

A two-way mixed-effects ANOVA compared the frequency and intensity of both negative and positive emotional facial expressions between PWA and control groups (i.e., main effect of group) as well as between females and males (i.e., main effect of sex). These comparisons were made across all four dependent variables: positive frequency, negative frequency, positive intensity, and negative intensity. Significant main or interaction effects were followed with pairwise comparisons. Pearson's *r* correlational analyses were used to explore whether aphasia severity relates to quantity and intensity of negative and positive emotional facial expressions.

Results

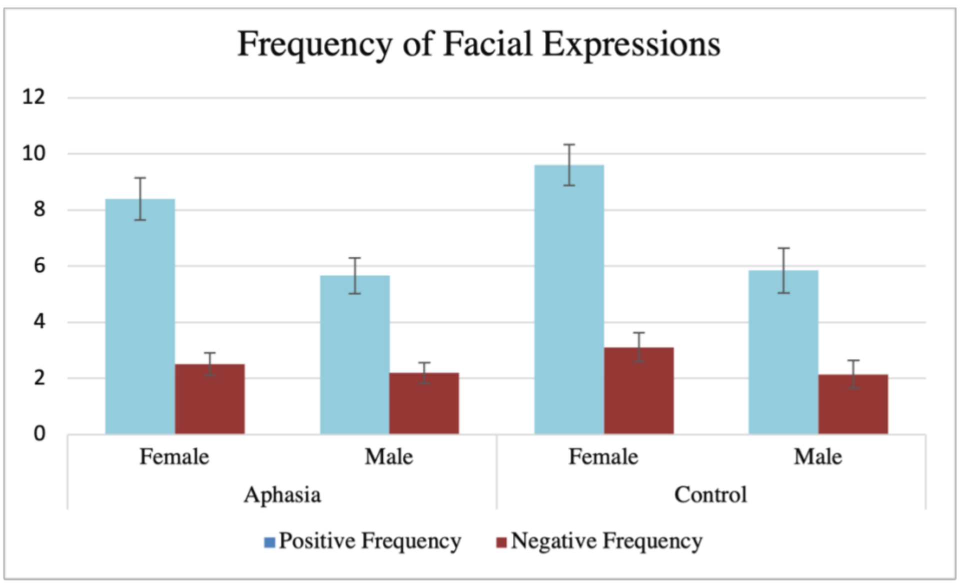
This study investigated how emotional discourse impacts both positive and negative frequency and intensity of emotional facial expressions produced between PWA and control participants. Overall, results show that female participants used more positive facial expressions compared to males, and female PWA participants produced less intense positive facial expressions compared to female control participants. Additionally, control participants produced more intense negative facial expressions than participants with aphasia.

Frequency

A two-way mixed-effects ANOVA showed that across aphasia and control groups, female participants used more positive facial expressions per minute than male participants (F [1, 49] = 14.11, p < .001, $\eta 2$ = .22). No main effect of aphasia or interaction effect was found indicating no difference in positive facial expressions per minute between aphasia and control groups. For negative facial expressions per minute, a two-way mixed-effects ANOVA showed no main or interaction effects between and across groups.

Figure 1

Frequency of Positive Facial Expression



Note. Females produced significantly more positive facial expressions compared to males. Error bars represent standard error from the mean.

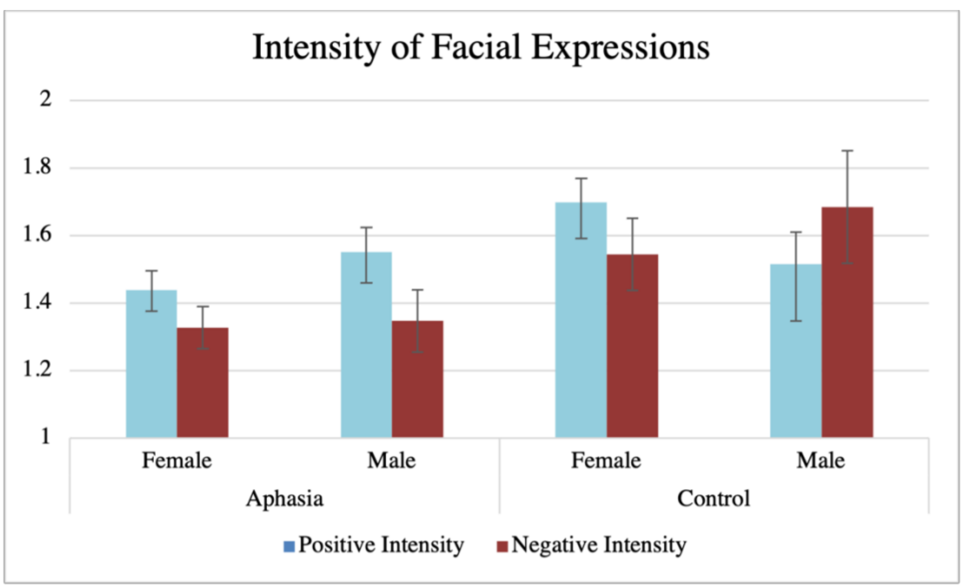
Intensity

For positive intensity, a two-way mixed-effects ANOVA showed no statistically significant main effect of aphasia, main effect of sex, or interaction effects. The interaction effect, however, showed a medium effect size (*F*[1, 46] = 3.46, p = .069, $\eta 2$ = .07). Given this medium effect size and the preliminary nature of the present study, we decided to follow up with pairwise comparisons. Post-hoc analysis showed that there was a difference in positive intensity between female participants with aphasia and female control participants (*t*[46] = 2.23, p = .031).

A two-way mixed-effects ANOVA showed that across male and female groups, control participants produced more intense negative facial expressions than participants with aphasia (*F*[1, 46] = 5.92, p = .019, $\eta 2$ = .11). No main effect of sex or interaction effect was found, indicating that whether the participant was male or female did not impact negative facial expression intensity.

Figure 2

Intensity of Facial Expressions



Note. Control participants produced significantly more intense facial expressions compared to PWA. Error bars represent standard error from the mean.

Severity Correlation

Pearson's *r* correlational analyses revealed no statistically significant correlation between severity of aphasia (WAB AQ scores) and any of our four dependent variables: positive and negative frequency and positive and negative intensity.

Table 3

Correlational Analysis Results

Variable	WAB-R AQ	
	r	*p*
Positive Frequency	-0.10882354	0.4425191
Negative Frequency	0.02521667	0.8591567
Positive Intensity	-0.19278957	0.1752853
Negative Intensity	-0.22086807	0.1448378

Note. WAB-R AQ = Western Aphasia Battery-Revised Aphasia Quotient.

Discussion

The central purpose of this study was to investigate both positive and negative frequency and intensity of emotional facial expressions produced between PWA and control participants during narrative discourse. Previous literature has predominantly focused on the differences in emotional facial expression production between participants with right hemisphere damage, left-hemisphere damage (most of these also had aphasia), and control participants. These studies generally show no difference between PWA and control participants (Blonder et al., 1993; Borod, 1993; Borod et al., 1986, 1988; Lorch et al., 1998). Thus, the current assumption is that PWA have spared emotional processing. Validating previous literature, we found that PWA produced a similar frequency of emotional facial expressions as control participants, which could be interpreted to confirm that PWA have generally spared emotional processing. Contrary to previous research, however, our results indicate that PWA demonstrate diminished intensity of emotional facial expressivity during narrative discourse.

PWA Produce Less Intense Emotional Facial Expressions

Results from this study concluded that, overall, PWA produced less emotionally intense positive and negative facial expressions compared to control participants. For negative intensity, it was found that PWA produced less intense facial expressions compared to control participants. For positive intensity, results indicated that female PWA participants produced less intense positive facial expressions compared to female control participants. Consistent with previous literature (Fischer & LaFrance, 2015), results from this study indicated that females produced a significantly higher frequency of positive facial expressions compared to males. Thus, the average intensity from positive frequency data was limited for males when compared to the female data. Due to the decreased quantity of facial expressions, it is plausible that higher power through a larger sample size could result in statistically significant intensity findings between male aphasia and male control participants.

One potential explanation behind the less intense positive and negative facial expressions produced by PWA lies in what Leung et al. (2017) described as the “distraction defect.” It is possible that due to language deficits associated with aphasia, PWA allocate a larger amount of cognitive and attentional resources towards language production. This, in turn, could result in less intense positive and negative facial expressions produced by PWA. This possibility is further highlighted by research showing reduced emotional expression in word-naming and affective prosody. Blackett et al. (2024) and Harmon et al. (2022) both found that negatively-valenced words created interference in emotional word-naming. Specifically, negative lexical retrieval resulted in longer response times and decreased accuracy (Blackett et al., 2024; Harmon et al., 2022). Additionally, research indicates that individuals with more severe aphasia were less likely to correctly identify and produce affective prosody (Leung et al., 2017). Because language deficits are a hallmark characteristic of aphasia, it is possible that an increase of attentional and cognitive resources allocated towards language production during emotional discourse tasks interferes with PWA's ability to produce emotional constructs efficiently and accurately (e.g., emotional words, emotionally intense facial expressions, and emotional prosody).

These findings have important clinical implications. Previous literature has found PWA to have intact abilities to produce appropriate emotional facial expressions, especially compared to individuals with right hemisphere damage (Blonder et al., 1993; Borod, 1993; Borod et al., 1986, 1988; Lorch et al., 1998). However, much of the previous research has focused on producing posed facial expressions and spontaneous facial expressions compared to control groups. Emotional processing is spared for PWA during posed and spontaneous facial expression tasks, evidenced by no significant difference in frequency of facial expressions between PWA and control participants (Borod et al., 1986, 1988; Lorch et al., 1998). Contrary to the results from this study, Borod et al. (1988) found a higher average intensity for PWA during spontaneous emotional facial expression tasks (i.e., reacting to positive and negative picture slides). However, these findings were numerical and not statistically significant. Methodologically, this study differed from previous research in that emotional facial expressions were produced during a language-based discourse task compared to spontaneously producing facial expressions based on reactions to positive and negative picture slides (Borod et al., 1988). It is possible, given the results from this study, that concentration on language production during discourse for participants with aphasia led to diminished intensity of facial expressions.

At first glance, it appears that the results from this study contradict the right hemisphere hypothesis which claims that producing emotional facial expressions is a right hemisphere dominant ability (Borod, 1993). Because PWA participants produced less intense facial expressions, it could be concluded that emotional expressivity deficits are not specific to individuals with right hemisphere damage. However, with consideration of attentional resource allocation, it seems that PWA have the *ability* to produce emotional facial expressions (Blonder et al., 1993; Borod, 1993; Borod et al., 1986, 1988; Lorch et al., 1998) but experience interference in this ability when language is embedded within the emotional facial expression production task (e.g., emotional discourse prompt). In other words, language production may act like a dual task, which causes PWA to allocate more attentional resources to language processing, resulting in less intense emotional facial expressions.

Higher Female Positive Expressivity Compared to Males

Positive frequency results indicate that females produce significantly more positive facial expressions than males. These findings are consistent with previous literature indicating that females are more emotionally expressive (Fischer & LaFrance, 2015). However, contrary to previous findings, results from this study indicated no difference between genders for negative frequency. One explanation for this could be a positivity bias driven by societal norms. For example, it is less common to see individuals crying during a negative or sad story compared to laughing during a positive or happy one. As such, due to decreased frequency of negative facial expressions, it is possible that higher power through a larger sample size could result in statistically significant differences between female and male participants.

Additionally, the finding that females produce higher frequency of facial expressions compared to males validates our modified FACES protocol (Kring & Sloan, 1991). The FACES protocol was originally designed for human coders to identify facial expressions while participants were performing an observation task. However, through modifying protocol procedures, our facial coders utilized the FACES protocol while participants were talking during emotional narrative discourse. While using this modified FACES protocol, our findings of higher facial expressivity for females compared to males is consistent with previous literature (Brody & Hall, 1993; Fischer & LaFrance, 2015).

Severity in Relation to Facial Expressivity

This study found no correlational relationship between severity of aphasia and any of the dependent variables measured. However, the majority of participants with aphasia fell into the mild to moderate severity range. During the video selecting portion of the methods, two of the disqualifying criteria were significant facial groping that interfered with natural facial expression and video samples that were less than 1 minute. However, these disqualifying criteria disproportionately excluded participants with more severe aphasia. Specifically, it could have excluded severe non-fluent aphasia participants (i.e., Broca's) who exhibit facial groping due to apraxia of speech. Limiting videos less than 1 minute also could have excluded severe non-fluent aphasia types whose verbal expression is severely limited, resulting in shorter narrative retells. As such, it is possible that changing the criteria to increase the number of participants with severe aphasia could show correlational relationships between severity and facial expressivity.

Limitations

This study provides important insights into the frequency and intensity of emotional facial expressions for PWA. Limitations for this study provide future direction for subsequent research. First, reliability indicates that negative intensity was the most difficult variable for which to achieve high reliability within and across coders. Participants generally produced less negative facial expressions, making the weight of each negative intensity rating greater compared to positive intensity. Adjustments could be made to the modified FACES protocol to make negative intensity ratings clearer and easier to obtain higher reliability within and between coders (Kring & Sloan, 1991).

Second, this study found no correlational relationships between severity of aphasia and frequency and intensity of facial expressivity. However, our exclusionary criteria during selecting videos potentially limited the amount of severe PWA participants (i.e., videos less than 1 minute and significant facial groping that interfered with natural facial expression). Furthermore, considerations should be made to include a wider range of aphasia severity. Although it could be difficult to include videos with significant facial groping due to the implications on correctly identifying intended facial expressions, shorter video lengths could be included.

Third, the participant sampling for this study was heterogeneous in nature. Participants for this study exhibited a wide range of both aphasia type and severity, which introduced higher variability within our sample. It is possible that our results would have been different if sampling were more homogeneous. Future research could consider focusing on a specific type or severity of aphasia, which, in turn, could result in different outcomes than the present study.

Fourth, this study utilized discourse samples taken from AphasiaBank. Although these discourse tasks were thought to contain some degree of emotional content, the intended purpose was not necessarily designed to be emotional. Because this study demonstrated less negative frequency, higher negative frequency data overall would create a better detailed understanding of negative intensity. As such, future studies should consider collecting emotional discourse samples (e.g., ones specifically designed to elicit positive or negative emotional facial expressions) to collect more detailed information about how emotional discourse impacts emotional facial expressivity in aphasia. Additionally, considerations should be made about the interviewer and participant interaction compared to a more naturalistic conversational setting in order to exhibit the most genuine facial production. Future studies could consider narrative discourse video samples between spouses, friends, or family in order for facial expression analysis to be as realistic to day-to-day conversations as possible.

Conclusion

This study found that female participants used more positive facial expressions compared to males and that female participants with aphasia produced less intense positive facial expressions compared to female control participants. Likewise, PWA participants produced less negatively intense facial expressions generally than control participants. These findings suggest that PWA participants allocated more attentional energy towards language during emotional discourse tasks, resulting in less intense facial expressions when compared to control participants. Additionally, increased female expressivity compared to males is consistent with previous research, validating our FACES protocol. Future research should consider the nature of discourse prompts in directly eliciting negative or positive facial expressions.

References

American Psychological Association. (n.d.). *Emotion*. In *APA Dictionary of Psychology*. Retrieved May 9, 2023, from https://dictionary.apa.org/emotions

Baum, S. R., Pell, M. D., Leonard, C. L., & Gordon, J. K. (2001). Using prosody to resolve temporary syntactic ambiguities in speech production: Acoustic data on brain-damaged speakers. *Clinical Linguistics & Phonetics*, *15*(6), 441–456. https://doi.org/10.1080/02699200110044813

Blackett, D. S., Borod, J. C., Speer, S. R., Pan, X., & Harnish, S. M. (2024). The effects of emotional stimuli on word retrieval in people with aphasia. *Neuropsychologia*, *192*, 108734. https://doi.org/10.1016/j.neuropsychologia.2023.108734

Blackett, D. S., Harnish, S. M., Lundine, J. P., Zezinka, A., & Healy, E. W. (2017). The effect of stimulus valence on lexical retrieval in younger and older adults. *Journal of Speech, Language, and Hearing Research*, *60*(7), 2081–2089. https://doi.org/10.1044/2017_jslhr-l-16-0268

Blonder, L. X., Burns, A. F., Bowers, D., Moore, R. W., & Heilman, K. M. (1993). Right hemisphere facial expressivity during natural conversation. *Brain and Cognition*, *21*(1), 44–56. https://doi.org/10.1006/brcg.1993.1003

Borod, J. C. (1993). Cerebral mechanisms underlying facial, prosodic, and lexical emotional expression: A review of neuropsychological studies and methodological issues. *Neuropsychology*, *7*(4), 445–463. https://doi.org/10.1037//0894-4105.7.4.445

Borod, J. C., Koff, E., Lorch, M. P., & Nicholas, M. (1986). The expression and perception of facial emotion in brain-damaged patients. *Neuropsychologia*, *24*(2), 169–180. https://doi.org/10.1016/0028-3932(86)90050-3

Borod, J. C., Koff, E., Lorch, M. P., Nicholas, M., & Welkowitz, J. (1988). Emotional and non-emotional facial behaviour in patients with unilateral brain damage. *Journal of Neurology, Neurosurgery, and Psychiatry*, *51*(6), 826–832. https://doi.org/10.1136/jnnp.51.6.826

Brody, L. R., & Hall, J. A. (1993). Gender and emotion. In M. Lewis & J. M. Haviland (Eds.), *Handbook of emotions* (pp. 447–460). Guilford Press.

Collignon, O., Girard, S., Gosselin, F., Roy, S., Saint-Amour, D., Lassonde, M., & Lepore, F. (2008). Audio-visual integration of emotion expression. *Brain Research*, *1242*, 126–135. https://doi.org/10.1016/j.brainres.2008.04.023

Feyereisen, P., & Seron, X. (1982). Nonverbal communication and aphasia: A Review. *Brain and Language*, *16*(2), 213–236. https://doi.org/10.1016/0093-934x(82)90084-0

Fischer, A., & LaFrance, M. (2015). What drives the smile and the tear: Why women are more emotionally expressive than men. *Emotion Review*, *7*(1), 22–29. https://doi.org/10.1177/1754073914544406

Harmon, T. G. (2024). Understanding and addressing the individualized emotional impact of aphasia: A framework for speech-language pathologists. *Seminars in Speech and Language*, *45*(1), 5–23. https://doi.org/10.1055/s-0043-1776418

Harmon, T. G., Johnson, A., Ward, V., & Nissen, S. L. (2023). Physiological arousal, attentiveness, emotion, and word retrieval in aphasia: Effects and relationships. *American Journal of Speech-Language Pathology*, *32*(5), 2554–2564. https://doi.org/10.1044/2023_ajslp-22-00305

Harmon, T. G., Nielsen, C., Loveridge, C., & Williams, C. (2022). Effects of positive and negative emotions on picture naming for people with mild-to-moderate aphasia: A preliminary investigation. *Journal of Speech, Language, and Hearing Research*, *65*(3), 1025–1043. https://doi.org/10.1044/2021_jslhr-21-00190

Kertez, A. (2007). *Western Aphasia Battery–Revised (WAB-R)* [Database record]. PsycTESTS. https://doi.org/10.1037/t15166-000

Kring, A. M., & Sloan, D. M. (1991). Facial Expression Coding System (FACES) [Database record]. APA PsycTests. https://doi.org/10.1037/t03675-000

Kring, A. M., & Sloan, D. M. (2007). The facial expression coding system (FACES): Development, validation, and utility. *Psychological Assessment*, *19*(2), 210–224. https://doi.org/10.1037/1040-3590.19.2.210

Leung, J. H., Purdy, S. C., Tippett, L. J., & Leão, S. H. S. (2017). Affective speech prosody perception and production in stroke patients with left-hemispheric damage and healthy controls. *Brain and Language*, *166*, 19–28. https://doi.org/10.1016/j.bandl.2016.12.001

Lorch, M. P., Borod, J. C., & Koff, E. (1998). The role of emotion in the linguistic and pragmatic aspects of aphasic performance. *Journal of Neurolinguistics*, *11*(1–2), 103–118. https://doi.org/10.1016/s0911-6044(98)00008-6

Walker, J. P., Joseph, L., & Goodman, J. (2009). The production of linguistic prosody in subjects with aphasia. *Clinical Linguistics & Phonetics*, *23*(7), 529–549. https://doi.org/10.1080/02699200902946944

Warriner, A. B., Kuperman, V., & Brysbaert, M. (2013). Norms of valence, arousal, and dominance for 13,915 English lemmas. *Behavior Research Methods, 45*, 1191–1207. https://doi.org/10.3758/s13428-012-0314-x

APPENDIX A

Annotated Bibliography

Blackett, D. S., Harnish, S. M., Lundine, J. P., Zezinka, A., & Healy, E. W. (2017). The effect of stimulus valence on lexical retrieval in younger and older adults. *Journal of Speech, Language, and Hearing Research*, *60*(7), 2081–2089. https://doi.org/10.1044/2017_jslhr-l-16-0268

Objective: The purpose of this article was to investigate how emotional picture-naming stimuli affects naming latency in healthy adults as well as determine the difference in naming latencies between healthy older and younger adults. *Methods:* Participants were asked to name 60 picture cards in sequential blocks—20 positively valenced, 20 negatively valenced, and 20 neutral—on a laptop computer. They were asked to name them "as quickly and as accurately as possible." In between the picture blocks, participants were asked to complete portions of the Spatial Span subtest of the Weschler Memory Scale to reduce carry-over effects. *Results/Conclusion:* Reaction times were longer for positive and negative stimuli compared to neutral stimuli. Additionally, reaction times were longer for healthy older adults compared to healthy younger adults. No significant difference was found between positive and negative stimuli for response time, contradicting the automatic vigilance effect. *Relevance to Study*: Emotionally based lexical naming in older adults results in longer processing time. Because most of our PWA fall into the older adult population and they already demonstrating naming deficits, emotional facial expression may be utilized more often to compensate for emotional naming difficulties.

Blackett, D. S., Borod, J. C., Speer, S. R., Pan, X., & Harnish, S. M. (2024). The effects of emotional stimuli on word retrieval in people with aphasia. *Neuropsychologia*, *192*, 108734. https://doi.org/10.1016/j.neuropsychologia.2023.108734

Objective: The purpose of this article is to investigate the effects of emotional stimuli on word retrieval for PWA compared to neurotypical controls. *Methods:* Thirteen PWA (10 male, three female) and 13 aged-matched controls (eight male, five female) were asked to asked to name positive, negative, or neutral lexical stimuli from the following categories: objects, actions, categories, or verbs. Valence blocks were randomized, and participants were asked to do different tasks in between each block to reduce carry-over effects. *Results/Conclusions:* The findings from the study suggest that PWA had less accurate and longer response times for negatively-valenced words. For positively-valenced words, the magnitude of the interference effect was not as great as the negative stimuli. However, researchers still found delayed response times and lower accuracy for positive stimuli. *Relevance to Study:* Emotional words are one channel in which emotion can be expressed. Understanding how positively or negatively valenced words can create interference effects for PWA is important in conceptualizing how emotional language is impacting day-to-day interactions.

Blonder, L. X., Burns, A. F., Bowers, D., Moore, R. W., & Heilman, K. M. (1993). Right hemisphere facial expressivity during natural conversation. *Brain and Cognition*, *21*(1), 44–56. https://doi.org/10.1006/brcg.1993.1003

Objective: The purpose of this study was to investigate the differences in facial expressivity between individuals with left hemisphere damage and individuals with right hemisphere damage in a natural, conversational home setting. *Methods:* Participants were asked to answer various emotional discourse prompts (i.e., "the effects of their illness on mood and communication," "the importance of religion in your life," etc.) in the comfort of their own homes with their wives. Their responses were videotaped and segmented into 10 second clips. Three female raters were trained to identify the participant's facial expressivity for each 10-second segment according to a 7-point Likert scale (1-absent to 7 extreme laughs, cries, or fearful yells). *Results/Conclusion:* The researchers found that participants with RHD exhibited less facial expressivity overall compared to the LHD and control groups. The RHD participants exhibited less positive facial affect (i.e., smiling and laughing) compared to the control groups, but demonstrated similar frequency of crying compared to the other groups. *Relevance to Study:* During the methods section, facial raters were asked to code these video segments with no audio, similar to the methods in this study. Additionally, while researchers were investigating emotional expressivity through facial expressions in RHD patients compared to LHD and control, our study wants to investigate LHD against a healthy adult control group.

Borod, Joan C., Koff, E., Perlman Lorch, M., & Nicholas, M. (1986). The expression and perception of facial emotion in brain-damaged patients. *Neuropsychologia*, *24*(2), 169–180. https://doi.org/10.1016/0028-3932(86)90050-3

Objective: The purpose of this study was to investigate the differences in emotional facial expression and perception in individuals with right hemisphere damage, left-hemisphere damage, and healthy adult controls. *Methods:* The participants in this study were tasked to look at negative and positive slides in both posed and spontaneous conditions. During the spontaneous portion, the individual was video recorded while reacting to the 10 positive and six negative slides for 20 seconds, and then was asked how they felt. During the posed

condition, participants were tasked with producing a facial expression that exhibited the following emotions: happiness, pleasant surprise, sexual arousal, sadness, anger, fear, disgust, and confusion. Additionally, participants were asked to identify which emotion was being expressed in nine slides. *Results/Conclusion:* Researchers found that individuals with right hemisphere damage exhibited difficulties in perceiving negative emotions, inferring that the right hemisphere is not only specialized for emotional facial expressions, but specifically negative ones. For facial expressivity, individuals with right hemisphere damage had difficulty producing posed positive expressions compared to LHD and control groups. *Relevance to Study:* This article indicates evidence that individuals with left hemisphere damage (majority of PWA participants) still have intact abilities to produce appropriate and intense facial expressions compared to individuals with right hemisphere damage.

Borod, J. C., Koff, E., Lorch, M. P., Nicholas, M., & Welkowitz, J. (1988). Emotional and non-emotional facial behaviour in patients with unilateral brain damage. *Journal of Neurology, Neurosurgery, and Psychiatry*, *51*(6), 826–832. https://doi.org/10.1136/jnnp.51.6.826

Objective: The purpose of this study was to examine if responsivity, appropriateness, and intensity across individuals with right hemisphere damage, left hemisphere damage, and controls were separate emotional constructs or were interconnected. Additionally, researchers wanted to look at whether or not facial movement equates to facial expression. *Methods:* The participants in this study were tasked to look at negative and positive slides in both posed and spontaneous conditions. During the spontaneous portion, the individual was video recorded while reacting to the 10 positive and 6 negative slides for 20 seconds, and then was asked how they felt. During the posed condition, participants

were tasked with producing a facial expression that exhibited the following emotions: happiness, pleasant surprise, sexual arousal, sadness, anger, fear, disgust, and confusion. *Results/Conclusion:* One of the main findings of this article was that there were no significant correlations between non-emotional facial expressions and emotional facial expressions, indicating that the ability to produce non-emotional facial movements does not correlate to producing emotional facial expressions. Another finding indicated that there were no significant differences in intensity between the three groups. The right hemisphere damage group also exhibited less appropriate positive facial expressions compared to the left hemisphere damage group. *Relevance to Study:* This article indicates evidence that individuals with left hemisphere damage (majority of PWA participants) still have intact abilities to produce appropriate and intense facial expressions. Additionally, the findings in this study indicated that there were no intensity differences for facial expressivity between all groups. Our study will not investigate facial expressivity for right hemisphere damaged patients, but it is possible that there will be no intensity differences between our PWA and control groups.

Borod, Joan C. (1993). Cerebral mechanisms underlying facial, prosodic, and lexical emotional expression: A review of neuropsychological studies and methodological issues. *Neuropsychology*, *7*(4), 445–463. https://doi.org/10.1037//0894-4105.7.4.445

Objective: The purpose of this article is to survey the literature regarding lexical, prosodic, and facial emotional expressivity to determine whether or not the right hemisphere is specialized for emotion regardless of valence. *Methods:* The author chose 24 studies of posed expression and 23 studies of spontaneous expression that examined lexical, prosodic, and facial emotional expression between RHD, LHD, and healthy controls. Data was collected regarding etiology, months post onset, subject characteristics, procedure types, number of positive and negative emotions, emotional rating measures used, and the statistical data from the study. *Results/Conclusion:* For facial expressions, the researchers found that individuals with anterior lesions (frontal lobe) demonstrated impaired expression compared to individuals with posterior lesions. Although the investigators anticipated that RHD individuals would demonstrate more difficulty with facial expressivity, the analysis indicated that there were no statistical differences between RHD and LHD. However, researchers explain that there are certain factors that explain these results (etiology of hemisphere damage, the type of stimuli presented, etc.). *Relevance to Study:* Right hemisphere is specialized for emotional expression. According to this study, it is possible that individuals with anterior lesions sites (non-fluent aphasia) may exhibit more difficulties with emotional facial expressivity compared to individuals with posterior lesions. However, it is important to note that there were many factors that played into this literature synthesis and may not reflect the most accurate data.

Collignon, O., Girard, S., Gosselin, F., Roy, S., Saint-Amour, D., Lassonde, M., & Lepore, F. (2008). Audio-visual integration of emotion expression. *Brain Research*, *1242*, 126–135. https://doi.org/10.1016/j.brainres.2008.04.023

Objective: The purpose of this study is to investigate how multi-sensory processing functions when presented with congruent and incongruent emotional auditory and visual stimuli. *Methods:* In Experiment 1, participants were tasked with identifying a specific emotion either auditorily-only, visual-only, or audio-visually. They were presented with 480 stimuli, separated into 5 blocks. After which, participants were tasked to identify an emotion in 360 "noisy" stimuli, separated into 5 blocks. In Experiment 2, participants were

involved in a “fear” and “disgust” discrimination task. Similar to Experiment 1, researchers presented the noiseless stimuli first and then the noisy stimuli for a total of 360 stimuli. *Results/Conclusion:* Experiment one demonstrated improved performance (lower inverse efficiency scores) in emotional processing during when bimodal sensory systems were activated (audio-visual integration). During the incongruent modal stimuli presentation (emotional auditory and visual stimuli did not match), participants attended to the visual stimuli to determine elicited emotion. However, during the noisy emotional auditory stimuli, participants attended to the auditory emotion elicited. During Experiment 2, researchers found that participants were more efficient in identifying the correct affect descriptor (i.e., fear vs. disgust) if they attended to the visual stimuli. *Relevance to Study:* This study concludes that there is better overall performance when the participant attends to the visual stimuli instead of the auditory stimuli. This finding directly correlates with our decision to have undergraduate research assistant code with no auditory stimulation in the background.

Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face and emotion. *Journal of Personality and Social Psychology*, *17*(2), 124–129. https://doi.org/10.1037/h0030377

Objective: The purpose of this article is to explore whether or not emotional facial expressions are universal or are specific to individual cultures. *Methods:* Researchers recruited 319 individuals from rural New Guinea to participate in this study. Participants were asked to listen to an emotion story targeting one of these common emotions: happiness, sadness, anger, surprise, disgust, or fear. The participants were then asked to look at a set of three pictures, with one of the pictures correlated to the described emotion. Participants were asked to complete 6–12 sets of stories and accompanying picture-

identification tasks. *Results/Conclusions:* The results from this study indicate that emotion identification is more universal, and not always culture specific. The New Guinean participants successfully identified the correct facial expression to the correct intended emotion, with the exception of the participant's difficulty in discriminating fear from surprise. This finding suggests that while cultures might not understand all emotional facial expression distinctions from culture to culture, facial expression identification is more universal. *Relevance to Study:* These findings validate research assistant's ability to code gestalt ratings for this project using a modified FACES protocol. Even if Aphasia Bank participants come from different culture backgrounds than our Western-based facial coders, this article suggests that the majority of facial expression identification is universal across cultures.

Feyereisen, P., & Seron, X. (1982). Nonverbal communication and aphasia: A Review. *Brain and Language*, *16*(2), 213–236. https://doi.org/10.1016/0093-934x(82)90084-0

Objective: This review of literature investigated gesture use in individuals with non-fluent and fluent aphasia as well as the implications of gesture use on communication. *Results/Conclusions:* One of the findings suggested that different types of aphasia may impact the ability to produce gestures, but also the frequency of gesture use. Specifically, non-fluent aphasia types may lead to hemiparesis of limbs, impacting ability to produce gestures bilaterally. In a single observational case study by Feyereisen (1982), a Wernicke's aphasia participant produced a higher number of gestures in a given amount of time. However, the Broca's aphasia participant produced a higher amount of gestures per word spoken, indicating that both fluent and non-fluent subtypes may be compensating for their verbal deficits in different ways. Specifically for Broca's, because their speech rate was slower, there was a larger number of gestures per word. *Relevance to Study:* This article demonstrates implications that aphasia subtypes may play a role in frequency of emotional facial expressions over time. Additionally, this may result in differing results based on whether or not our data files are predominantly from non-fluent or fluent participants.

Fischer, A., & LaFrance, M. (2015). What drives the smile and the tear: Why women are more emotionally expressive than men. *Emotion Review*, *7*(1), 22–29. https://doi.org/10.1177/1754073914544406

Objective: The purpose of this article is to survey the literature regarding the difference in facial expressivity between men and women and the psychology behind these findings. *Results/Conclusion:* The evidence from this survey of literature suggests that women exhibit more emotional facial expressions that are also more intense. Researchers believe that gender norms play a role in determining which gender is more emotional expressive. However, evidence indicates that women, on average, cry and smile more often than men. *Relevance to Study:* This article suggests that women exhibit more facial expressions in general. However, it is also suggested that men could potentially exhibit more positive expressions, specifically smiling, during distressing instances (e.g., retelling stroke story for this study) in order to regulate stress. Overall, using the evidence from the article, it is predicted that women will exhibit more facial expressions than men because research indicates it is easier to decode female facial expressions compared to men, and they will exhibit more intense facial expressions than men.

Harmon, T. G., Nielsen, C., Loveridge, C., & Williams, C. (2022). Effects of positive and negative emotions on picture naming for people with mild-to-moderate aphasia: A preliminary investigation. *Journal of Speech, Language, and Hearing Research*, *65*(3), 1025–1043. https://doi.org/10.1044/2021_jslhr-21-00190

Objective: The purpose of this article is to determine how emotional valence and arousal affect naming and response time for PWA and healthy older *and* younger adults. *Methods:* Participants were asked to name pictures "as quickly and accurately as possible" following variations of ABA and ACA (when A = neutral, B = negative, and C = positive). Upon naming the picture, participants were asked to complete the Self-Assessment Manikin (SAM), self-reporting perceived arousal and perceived pleasure. *Results/Conclusion:* Overall, researchers found longer response times for negatively valence words in both the PWA and older adult groups, creating interference with lexical retrieval. Additionally, PWA had less accurate naming and longer response times compared to both older and younger adults. There were no statistically significant findings for response time or accuracy for positive words. All three participant groups reported similar perceived arousal and pleasure, demonstrating that PWA experience emotion similarly to individuals without aphasia. *Relevance to Study*: Emotional lexical retrieval is just one component in creating emotional communication responses. If negatively valenced word naming is less accurate and creates longer responses times for PWA, it is possible that they utilize facial expressions as a way to compensate for language naming deficits. Additionally, PWA experience emotion similar to individuals without aphasia.

Harmon, T. G., Johnson, A., Ward, V., & Nissen, S. L. (2023). Physiological arousal, attentiveness, emotion, and word retrieval in aphasia: Effects and relationships. *American*

Journal of Speech-Language Pathology, 32(5S), 2554–2564. https://doi.org/10.1044/2023_ajslp-22-00305

Objective: The purpose of this article is to compare the physical arousal and attentiveness of emotional stimuli during a confrontational naming task between PWA and healthy adults and to explore relationships between the following: physiological arousal, attentiveness, perceived arousal, and naming accuracy. *Methods:* Participants were asked to name pictures “as quickly and accurately as possible” that followed variations of ABA and ACA when A = neutral, B = negative, and C = positive. ECG electrodes were placed on the wrist and forearm (HR) and skin conductance (SC) electrodes were placed on the fingertips of the participant’s nondominant hand to collect biophysiological data for each naming trial. *Results/Conclusions:* Overall, PWA had lower levels of physiological measures (i.e., heart rate and skin conductance) compared to the healthy adult control group with the exception of heart rate variation in which both groups measured similarly. As such, the researchers believe that PWA may experience lower levels of arousal and attentiveness during emotional naming. This can lead to difficulty attending to conversations even when the pressure and stress is high. Additionally, attentiveness was found to be highly correlated with naming accuracy and response time. *Relevance to Study*: This study suggests that even when naming emotional stimuli, PWA can have difficulty attending to the task at hand and are not as aroused compared to their healthy adult counterparts. Although this study focused on attention at a lexical level, it is unknown as to whether PWA demonstrate difficulty attending to their own facial expressions during emotional discourse.

Harmon, T. G. (2024). Understanding and addressing the individualized emotional impact of aphasia: A framework for speech-language pathologists. *Seminars in Speech and Language, 45*(1), 5–23. https://doi.org/10.1055/s-0043-1776418

Objective: The purpose of this article is to explore a framework that helps clinicians understand individualized emotional responses for PWA and to provide clinical strategies to emotionally support PWA. *Methods:* The author created a framework for speech-language pathologists to help identify individual emotional responses for PWA and how to incorporate emotion into practice. *Results/Conclusion:* Emotional responses, language processing, and social participation are all interconnected components that play into an individual's emotional communication experience. Additionally, the ability to strengthen an individual's social support, actively listen, create clinical situations to evoke day-to-day emotional responses, and help individuals reframe their situation are clinically imperative to support PWA emotionally. *Relevance to Study:* This article emphasizes that the emotional impact on language, communication, and social participation are frequently individual experiences, and cannot always be generalizable. Thus, it implies that there is a potential for variability of emotional facial expressions between PWA. Additionally, this article describes how personal characteristics play a role in what emotions are expressed. For instance, someone who is generally happier will likely exhibit more positive facial expressions, which is why baseline facial expressions need to be determined during the facial coding process.

Hazamy, A. A., Horne, S. A., Okun, M. S., Hass, C. J., & Altmann, L. J. (2019). Effects of a cycling dual task on emotional word choice in Parkinson's disease. *Journal of Speech,* *Language, and Hearing Research, 62*(6), 1951–1958. https://doi.org/10.1044/2019_jslhr-l-18-0428

Objective: The purpose of this article was to investigate how emotional word retrieval would be affected during single and dual-tasks for people with Parkinson's Disease (PD) and healthy older adult (HOA) participants. *Methods:* Participants were asked to answer a discourse prompt (e.g., "Please tell me about a person who had an important impact on your life.") as a baseline (single task) before the dual-task. Next, participants were asked to cycle for 2 minutes to collect single-task data (i.e., heart rate). Lastly, participants were asked another discourse prompt, in which they only had three minutes to retell, and were asked to simultaneously cycle at the same time. *Results/Conclusions:* There were no significant differences in emotional language production between PD and HOA groups during the single-task discourse. Additionally, there was a decrease in the use of emotionally laden words during discourse in the dual-task for people with PD. *Relevance to Study:* PWA have been found to exhibit attentional deficits that co-occur with common language deficits. This article gives insight into the possibility that when given a dual-task—such as recounting an emotional story (i.e., stroke story or important life event story)—attending to both language tasks and facial expressions might decrease the overall emotionality of the discourse because of the increased load placed on the language system.

Kring, A. M., & Sloan, D. M. (1991). Facial Expression Coding System (FACES) [Database record]. APA PsycTests. https://doi.org/10.1037/t03675-000

Objective: The primary objective of creating a new facial coding system is that previous systems have focused on discrete models of emotion—identifying a number of specific emotions. However, FACES encompasses a less time-consuming dimensional model of emotion, encompassing valence (i.e., positive and negative) *and* arousal (i.e., intensity)—that can be completed by human raters. *Methods:* Identify the moment an individual goes from a neutral display to a non-neutral display (facial expression) back to a neutral display to calculate duration. Rate the valence (i.e., positive or negative) and the intensity of the emotional facial expression exhibited (i.e., Likert scale of 1–4). *Results/Conclusion:* This coding system was originally utilized for video footage of an individual watching a video clip intended to elicit a certain type of emotion. Researchers encouraged raters to look out for these specific things when coding: shifting body positions, eyeglasses, hand covering part of their face, talking, facial tics, etc. *Relevance to Study:* This is the facial coding system utilized by research assistants for this study. Because the PWA and control participants being coded are speaking in the videos and are retelling emotional stories, the Likert scale intensity descriptions for positive and negative intensity have been modified for this study.

Kring, A. M., & Sloan, D. M. (2007). The facial expression coding system (FACES): Development, validation, and utility. *Psychological Assessment*, *19*(2), 210–224. https://doi.org/10.1037/1040-3590.19.2.210

Objective: The purpose of this article is to investigate if the FACES protocol developed by Kring and Sloan (1991) could be validated against prior facial coding mechanisms such as EMFACS, EMG, Difference Measures, psychophysiological measures and reports of experienced emotion. *Methods:* During the validation of FACES and EMFACS, 60 undergraduate students participated in watching clips that were categorized by the following: happiness, fear, and disgust. Two coders utilized the EMFACS

dictionary to code participant emotions. During the validation of FACES and EMG, 290 undergraduate students, community adults, and schizophrenia patients viewed video clips—one that elicited disgust and one that elicited amusement. Electrodes were placed on the zygomatic and corrugator regions of the face to collect EMG activity. During the validation of FACES and Individual Differences Measures, 252 undergraduate students were asked to watch a film that was intended to elicit some type of emotion (e.g., amusement, disgust, happiness, fear, etc.). After watching the clip in a large group setting, each individual was tasked to complete the following self-reports: Emotional Expressivity Scale (EES), Family Expressiveness Questionnaire (FEQ), NEO Scales (Neuroticism, Extraversion, Openness, Conscientiousness, Agreeableness), and the Rosenburg Self-Esteem Scale. During the validation of FACES and other psychophysiological measures, 274 undergraduate students and community adults watched emotional film clips where psychophysiological data was collected (i.e., heart rate and skin conductance level). During the validation of FACES and reports of experienced emotion, 395 undergraduate students, community adults, and schizophrenia patients completed one of three different types of emotional experience rating scales all assessing valence and activation (i.e., two 7-point Likert scales, a scale containing 20 emotion terms, or a 44-item scale). *Results/Conclusion:* For FACES and EMFACS, FACES duration and frequency codes for both positive and negative facial expressions were highly correlated with EMFACS. FACES ratings of positive expressions were significantly correlated with EMFACS for expressions such as enjoyment and social smiles, with a higher correlation for enjoyment smiles. FACES negative expressions were correlated to the composite scores for disgust films, as FACES does not distinguish or identify between types negative expression. For FACES and EMG, FACES positive ratings had correlation with zygomatic facial EMG activity for frequency (except for U1), intensity, and duration. FACES negative facial ratings of frequency, intensity, and duration were related, but less robustly correlated with corrugator EMG activity. For FACES and Individual Differences Measures, most of the correlation data came from the NEO scales. Positive and negative expressive behavior identified through FACES were found to be moderately related to the conceptual correlates of the NEO scales (e.g., neuroticism was not found to be related to frequency or intensity, but significantly correlated to duration, agreeableness was correlated to FACES positive and negative expressions, etc). For FACES and other psychophysiological measures, FACES positive ratings positively correlated with skin conductance for three of five groups and negative ratings correlated with all five groups. Additionally, heart rate correlated with both positive and negative FACES ratings for two out of five groups. Because psychophysiological ratings vary, these results are consistent with other studies that looked into these types emotional responses. For FACES and reports of experienced emotion, significant correlation occurred between the amusement film and positive FACES ratings. Although amusement was the highest, there was also correlation between positive FACES ratings and the ratings for the happy film. FACES negative ratings were only moderately correlated to the fear film. However, this could be due to the fact that there were not that many negative expressions found in the film for FACES to be coded. *Relevance to Study:* FACES protocol is a valid measure to quantify duration, intensity, and valence for our project. The studies validating FACES against EMFACS and reports of experienced emotion are the most relevant. Additionally, high reliability

was achieved between the FACES raters, suggesting that facial coding agreement can be achieved when utilizing the FACES protocol. (Additionally, both EMFACS and reports of experienced emotion (with the exception of too few negative codes for fear film in reports of experienced emotion) were found to be valid when compared to FACES codes.)

Lorch, M. P., Borod, J. C., & Koff, E. (1998a). The role of emotion in the linguistic and pragmatic aspects of aphasic performance. *Journal of Neurolinguistics*, *11*(1–2), 103–118. https://doi.org/10.1016/s0911-6044(98)00008-6

Objective: The purpose of this study was to explore linguistic and extralinguistic aspects of emotional communication for PWA and individuals with right hemisphere damage. *Methods:* Participants were asked to look at 16 emotionally laden slides. Each slide was shown for 20 seconds and after 6 seconds, participants were asked to describe their feelings towards the picture. Two human raters were tasked with rating the spontaneous emotional facial expressions exhibited during the presentation of each slide. *Results/Conclusions:* LHD participants were found to have similar accuracy for posed and spontaneous facial expression compared to the control group. Additionally, LHD participants were found to have higher levels of emotional linguistic expression compared to controls and RHD participants. Overall, LHD participants were found to be equal or more highly rated in various forms of emotional communication (e.g., expressing valence, use of discourse in emotional contexts, intensity of posed facial expressions, etc.) compared to RHD participants and controls. *Relevance to Study:* This article indicates that PWA demonstrate the ability to produce emotional facial expressions, if not more than their healthy control counterparts. This evidence plays into the project hypothesis of PWA, especially those with more severe diagnoses, producing more emotional facial expressions compared to healthy adults.

Roche, J. M., & Arnold, H. S. (2018). The effects of emotion suppression during language planning and production. *Journal of Speech, Language, and Hearing Research, 61*(8), 2076–2083. https://doi.org/10.1044/2018_jslhr-l-17-0232

Objective: The purpose of this article is to investigate how language production interacts and is impacted by emotional regulation during discourse. *Methods:* Two participants at a time were escorted into two different testing rooms and watched 11-minutes of the film "Hiroshima: BBC History of World War II." After the video, one of the partners was asked to not express emotional affect (e.g., "be stoic when describing your feelings") or was asked to express emotion outwardly (e.g., facial expressions, expressive gestures, etc.). After given their assignments, participants were asked to discuss their thoughts and feelings about the video. *Results/Conclusions:* The participants who were asked to regulate their emotions during the conversation were found to exhibit more speech disfluencies when they provided more complex sentences. The increase in disfluencies potentially indicates that emotional suppression requires more attentional and cognitive demand than increased emotional expression. Additionally, participants who were asked to either suppress emotion or express more emotion were found to have larger lexical diversity. *Relevance to Study:* This article details the effects of emotional regulation for all populations, including PWA. If regulating emotion during a retell of one's stroke story results in more conversational disfluencies, it is possible that PWA might attend to their facial expressions more than their language to convey the same emotional meaning more effectively.

APPENDIX B

International Review Board Approval Letter

Memorandum

To: Tyson Harmon, Ph.D.
Department: BYU - EDUC - Communications Disorders
From: Sandee Aina, MPA, HRPP Associate Director
Wayne Larsen, MAcc, IRB Administrator
Date: March 07, 2023
IRB#: IRB2023-082
Title: Comparing Emotional Facial Expressions Produced During Personal Narrative Discourse by People With and Without Aphasia

Thank you for your recent correspondence concerning your protocol referenced in the subject heading. Based on your application, the IRB has determined that this scholarly activity does not meet the regulatory definition of human subjects research 45 CFR 46.102(e)(1)(i)(ii).

APPENDIX C

Facial Expression Coding System

Appendix

FACES Coding Sheet

Participant ________ Film # ________ Rater ________ Page ______

Time start _________ Time end _________ Duration _________

Valence: Positive ___ Negative ___

Intensity: low medium high very high
1 2 3 4

Time start _________ Time end _________ Duration _________

Valence: Positive ___ Negative ___

Intensity: low medium high very high
1 2 3 4

Time start _________ Time end _________ Duration _________

Valence: Positive ___ Negative ___

Intensity: low medium high very high
1 2 3 4

Time start _________ Time end _________ Duration _________

Valence: Positive ___ Negative ___

Intensity: low medium high very high
1 2 3 4

Time start _________ Time end _________ Duration _________

Valence: Positive ___ Negative ___

Intensity: low medium high very high
1 2 3 4

Positive and Negative Affect Descriptors

Positive	*Negative*
Happy	Miserable
Delighted	Distressed
Glad	Annoyed
Amused	Jittery
Pleased	Nervous
Content	Angry
Satisfied	Gloomy
Calm	Anxious
Serene	Afraid
Excited	Tense
Astonished	Alarmed
Cheerful	Frustrated
Surprised	Disgusted
Active	Depressed
Content	Hostile

FORCED CHOICE FORMAT SUMMARY SHEET

SUMMARY SHEET

Participant _____ Rater _______
Clip # _____

What was the predominant emotion being expressed throughout the clip?

A. Interest
B. Sadness
C. Anger
D. Surprise
E. Fear/Disgust
F. Neutral/Indifferent
G. Happiness

What is the overall level of expressiveness for this person for this clip?

low	fairly low	medium	fairly high	high
1	2	3	4	5

Number of positive expressions _________

Number of negative expressions _________

Mean intensity--positive _________

Mean intensity--negative _________

Duration of positive expressions ____________ (in seconds)

Duration of negative expressions ____________ (in seconds)

LIKERT FORMAT SUMMARY SHEET:

FACES Summary Sheet

Participant _____ Film # _____ Rater ____

Please rate the degree to which the participant <u>expressed</u> each of the following emotions using the scale below:

Not at all = **1** slightly = **2** somewhat = **3** moderately = **4** quite a bit = **5** very much = **6**

Interest ___ sadness ___ happiness ___ anger ___ fear ___ amusement ___ disgust ___

What is the overall level of expressiveness for this person for this film?

low	fairly low	medium	fairly high	high
1	2	3	4	5

Number of positive expressions____________ Number of negative expressions _____
Mean positive intensity _____ Mean negative intensity _____
Duration of positive expressions _____ Duration of negative expressions _____

☺☹☺

Participant _____ Film # _____ Rater _____

Please rate the degree to which the participant <u>expressed</u> each of the following emotions using the scale below:

Not at all = **1** slightly = **2** somewhat = **3** moderately = **4** quite a bit = **5** very much = **6**

Interest ___ sadness ___ happiness ___ anger ___ fear ___ amusement ___ disgust ___

What is the overall level of expressiveness for this person for this film?

low	fairly low	medium	fairly high	high
1	2	3	4	5

Number of positive expressions____________ Number of negative expressions _____
Mean positive intensity _____ Mean negative intensity _____
Duration of positive expressions _____ Duration of negative expressions

APPENDIX D

Modified FACES Protocol

1. Open the Aphasia Bank participant video through VLC media player.
    a. Search designated video in downloads on lab computer
        i. Videos are labeled by participantID_stroke/important
    b. Right click to open the video through VLC media player
    c. If the milliseconds are covering the participant's face, contact Chloe or Anna and we can help you fix the issue.

2. Open the video full screen on one monitor with NO AUDIO. Use Airpods or headphones to help with noise cancelation. Open the Excel document on the other monitor.

3. Watch at least 30 seconds of the participant video to understand the participant's baseline face.
    a. This portion of the protocol is EXTREMELY important. You may misinterpret facial expressions if someone's resting face is generally happy or generally sad. Use their normal talking face as a baseline to go off of.

Before beginning the actual facial coding, here are some reminders!

- We are coding facial expressions, NOT gestures. Try to avoid involving gestures in your decision making. This includes head nods, moving their hand to their face, etc.
- Make sure you are in a quiet environment. We do not want background music or people talking to distract or influence you in anyway.
- If the video is poor quality or you are having a hard time seeing their face, let us know BEFORE you start coding.
- If the intensity of the facial expression changes, code it as two different expressions rather than one.

4. Next, go back to the start of the sample. Begin the video again, and search for facial expressions.

5. Once a facial expression is found, try your best to identify exactly when the participant goes from a neutral face to a non-neutral face (pausing the video frame by frame will be helpful here). Write down this time (milliseconds) in Excel. Play the video until you find the exact moment when the participant goes from a non-neutral face (the facial expression) back to their neutral face (again, pausing may be helpful). Write down the end time. (If the facial expression does not return to neutral but changes, code both facial expressions separately, even if they are both positive/negative but with different intensity levels.)

6. Once you enter the start and end time, Excel should calculate the time difference for the facial expression (the duration). If Excel is not auto-populating the duration, put your mouse in the corner of the box until it becomes a plus sign. Drag downwards until it auto populates the formula.

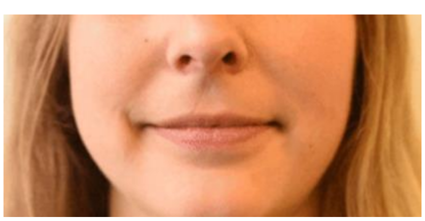
7. Next, decide whether the facial expression is positive or negative. Frequently, this is a difficult decision. So, when deciding what to mark, consider if their facial production could be expressed by any of these emotional descriptors.

Positive and Negative Affect Descriptors

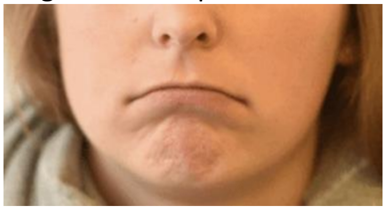
Positive	*Negative*
Happy	Miserable
Delighted	Distressed
Glad	Annoyed
Amused	Jittery
Pleased	Nervous
Content	Angry
Satisfied	Gloomy
Calm	Anxious
Serene	Afraid
Excited	Tense
Astonished	Alarmed
Cheerful	Frustrated
Surprised	Disgusted
Active	Depressed
Content	Hostile

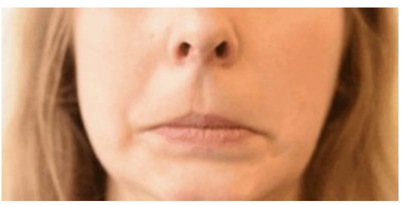
Also under positive list:

Positive examples:



Negative examples:



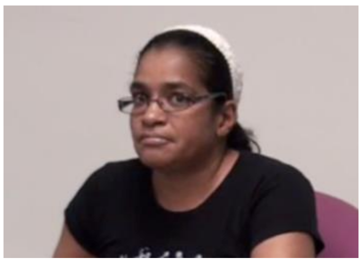
One facial expression that is frequently difficult to determine the valence for is eyebrow raises. If you do not feel like the eyebrow raise that your participant exhibits is portrayed in these positive or negative lists, decide whether the expression is pensive (which will be marked as positive) or tense (which will be marked as negative).

The following example should help:

Tense (negative)

This participant's brow is furrowed. His eyes are closed and the facial expression is more serious or concentrated rather than thoughtful.

Pensive



When a participant is raising their eyebrows and you are wondering whether that is their "neutral face" or a facial expression ask yourself these questions:

1. Is this a result of articulatory movement? Do they have facial groping/difficulty with moving their mouth to articulate what they desire to say?
    a. IF YES! Then, do not code these mouth/articulation movements. We do not believe that these movements provide emotional information. However, if another unit of their face is demonstrating emotion and is not a result of articulation (furrowed, tense brows and eyes closed), you will still code these movements.
2. Are these facial movements intentional? Is it used to convey attention or interest? Even if they do it often, is it purposeful?
    a. IF YES! Then code these facial expressions. We believe that they convey emotional information.

8. Once valence has been determined, intensity must be decided. This is on a scale of 1-4.

Sometimes facial expressions morph from one intensity to another intensity. If that is the case, code two different facial expressions, one for the first intensity and the second for the second intensity. If this is the case, each segment of the facial expression needs its own start and end time, valence, and intensity rating. Treat them as if they are two separate facial expressions even though the intensity changed from one to another.

*If you find yourself being biased into coding longer facial expressions as more intense, try and pause the video at the peak of the facial expression. Use that snapshot to help you decide what intensity rating!

Units of the Face to Consider when Coding:
*When a unit of the face is paired (right/left eyebrows), the unit is counted only once, no matter the combination of pairing the participant exhibits. For example, a participant may raise their left eyebrow, right eyebrow, or both eyebrows simultaneously. No matter the combination of eyebrow movements, each of these different scenarios would still be counted as only **ONE** unit of the face participating in the facial expression. Keep this in mind when deciding intensity ratings where you will be considering how many facial units.

Eyebrows (furrowing, raising)
Corners of the Mouth (drawn upwards, drawn downwards)
Lips (smiling, frowning, puckered)
Eyes (tense, focused, widened, narrowed)
Forehead (scrunched)
Nose (scrunched, nostrils flared)
Teeth (gritting teeth, smiles with teeth)
Cheeks (tensing muscles)

*We do not code eye movements, whether that be up/down/right/left. The only movement would we code is eye rolling, widening of eyes, intentional eye closure (not normal blinking), or narrowing of eyes.

Low Rating=1
Positive 1: The positive 1 rating should be given when only one part of the face is involved in the expression. It should be barely noticeable; often you will barely be able to tell if this is a facial expression or not. Eyebrow raises that look inquisitive or pensive may also be given this rating. Only one unit of the face is involved (eyebrows raised OR lips upturned).

(eyebrow raise: 1 unit)

Negative 1: The low rating should be given when only unit of the face is involved in the expression. It should be barely noticeable; often you will barely be able to tell if this is a facial expression or not. For example, eyebrow raising that looks tense rather than pensive, lowers corners of mouth. Only one unit of the face is involved (eyebrows furrowed OR lips downturned).

(lips downturned: 1 unit)

Medium Rating=2

Positive 2: The positive 2 rating should be given when two units of the face (e.g., eyebrows raised AND eye widening) of the face are used in the facial expression. This rating should NOT be given when the expression is a smile with teeth (see Positive 3).

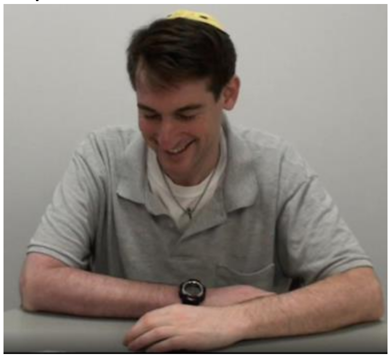
(lips upturned, eyebrows raised (hard to see from picture; no teeth): 2 units)

Negative 2: The expression must be moderate but not too pronounced. It is recognizable but not so intense that it draws a lot of attention. The negative 2 rating should be given when two units of the face (e.g., eyebrows furrowed and eyes narrowed) used in the facial expression. This rating should NOT be given when the expression is a pronounced frown (see Negative 3).

(eyebrows furrowed, eyes narrowed: 2 units)

High Rating=3

Positive 3: This rating should be given when 3 or more units of the face are involved in the expression, or there is a smile with teeth. *Teeth must be shown for this rating.*



(eyebrows raised, mouth upturned, & teeth shown: 3 units)

Negative 3: This rating should be given when 3 or more units of the face are involved in the expression, or there is a visible frown, intensely furrowed eyebrows, AND intense eyes. *Scowls and frowns receive an automatic 3*

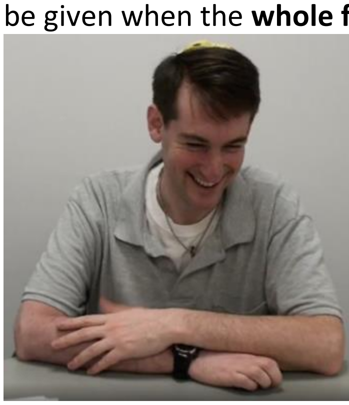
Scowl: eyebrows furrowed, eyes narrowed, corners of mouth downturned

Frown: cheeks tensed, forehead wrinkled, corners of mouth downturned

(eyes narrowed, eyebrows scrunched, snarled nose: 3 units)

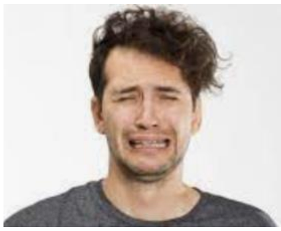
Very High Rating=4

Positive: "The very high rating is reserved for those expressions that are very intense. An example of such an expression is one where a participant is undeniably laughing, with the mouth completely open with the eyebrows and cheeks substantially raised." This rating should be given when the **whole face** is involved in the expression or the person is audibly laughing.



(visibly laughing with every part of the face involved: 4)

Negative: Similar. "Reserved for those expressions that are VERY intense." Crying, every part of the face is involved in some type of negative emotion (eye closed, distressed, down turned lips, etc.) This rating should be given when **every part** of the face is involved in the expression or they are visibly crying. This rating is also given when four different parts of the face are involved.

Ex.  (This would be a good example of a 4 because every part of the face is involved in emotional expression somehow. This man's eyes are closed, his brow is turned downward/furrowed, he is grimacing, teeth exposed, lip could be quivering, maybe even crying.)

9. Once you have completed duration, valence, and intensity ratings you have completed coding that facial expression! Click "yes" if the participant exhibits another facial expression and complete steps 5-9 all over again.

10. Please code for 20 minutes and then take a 5-minute break. We recommend setting timers so you do not lose track of time coding. This step cannot be skipped. It is crucial that you code consistently throughout the whole sample, especially during videos that are longer or participants that have a large amount of facial expressions. In order to combat burnout, we recommend you take a break, stretch, go for a quick walk, get water, eat fruit snacks, etc.

Secondary Coding:
*Secondary coding will be completed the week after you have done the primary coding.

11. Once you feel like you have coded all the facial expressions from one sample, go through it a **second time** and double check that you agree with **all** your decisions. You will not have completed the participant until your work is checked twice.

While this is your second time running through this file, these are the three expectations for when you pass through codes a second time.

1. Check the codes you did.
    a. Do you need to change the intensity? Valence? Time start/time end?
2. Do you need to add codes?
    b. In order to add a row, make sure you are on the "Home" tab of the excel file. Look to the top right-hand corner, where you will click on the "Insert row" button to create a new row for the new code.
3. Do you need to eliminate codes?
    a. Look to the top right-hand corner, where you will click on the "Delete row" button.

Gestalt Ratings:

12. Once you have finished coding, you will complete the GESTALT ratings.

13. Please go back to the beginning of the video and watch it **once** the whole way through.

14. Choose the overall **predominant emotion** (interest, sadness, anger, surprise, fear/disgust, neutral/indifferent)

15. Then, rate the participants overall **level of expressiveness** on a scale of 1-5 (1 – low, 2 – fairly low, 3 – medium, 4 – high, 5 – very high).

16. The second part of GESTALT is rating each participant on how much they expressed **seven different emotions** (interest, sadness, happiness, anger, fear, amusement, and disgust). Participants will be rated on a scale of 1-7.

   a. 1 – not at all (the participant NEVER exhibits this emotion)
   b. 2 – slightly (the participant exhibits this emotion a couple of times)
   c. 3 – somewhat (the participant exhibits this emotion more than a couple of times but less than half of the time)
   d. 4 – moderately (the participant exhibits this emotion around half of the time)
   e. 5 – quite a bit (the participant exhibits this emotion more than half the time but not quite all the time)
   f. 6 – a lot (the participant exhibits this emotion nearly all of the time but they occasionally show other emotions)
   g. 7-all the time (this is the only emotion the participant shows)

APPENDIX E

Facial Coding Checklist

Facial Coding Checklist: Primary Coding

Coder Name:________________ Date:__________________ File:___________________

Coding Session Set-up:

☐ Open the video file, full screen, on one monitor.

☐ Open data analysis excel sheet on the other monitor.

☐ Eliminate distractions.

- ☐ Turn off the audio for the video.
- ☐ If available, put in noise cancelling earphones.

Data Analysis:

☐ Watch video for 30+ seconds to understand baseline face.

*After watching 30 seconds, if you feel like the video is too difficult to code (meaning the video is too poor of quality, you cannot see their whole face, consistent glasses glare so you can't see eyes, etc.) then let Anna or Chloe know and move on to next file assignment/wait to be reassigned

☐ Begin Coding

- ☐ Code for 20 minutes.
- ☐ Take a 5-minute break. (Your breaks should be included in LS hourly report)

☐ Reacclimate yourself to baseline face through watching 15-30 seconds of video.

☐ Code for 20 minutes.

☐ Take a 5-minute break.

- ☐ Watch 15-30 seconds of video for baseline face.
- ☐ Code for 20 minutes.
- ☐ Take a 5-minute break.

Gestalt Ratings:

☐ After finishing your codes, watch the whole video through one more time (start to end).

☐ Use your best judgement to complete the gestalt ratings.

Reporting:

☐ Check this box if you still have more coding to finish.

☐ Check this box if you finished coding the file and marked it complete on task tracking doc.

Facial Coding Checklist: Secondary Coding

Coder Name:________________ Date:__________________ File:___________________

Coding Session Set-up:

☐ Open the video file, full screen, on one monitor.

☐ Open data analysis excel sheet on the other monitor.

☐ Eliminate distractions.

- ☐ Turn off the audio for the video.
- ☐ If available, put in noise cancelling ear phones.

Parameters for 2nd pass of your codes:

While this is your second time running through this file, these are the three expectations for when you pass through your codes a second time.

1. Check the codes you did. ☐ (check off when you have completed this)
   a. Do you need to change the intensity? Valence? Time start/time end?
2. Do you need to add codes? ☐ (check off when you have completed this)
   a. In order to add a row, make sure you are on the "Home" tab of the excel file. Look to the top right-hand corner, where you will click on the "Insert row" button to create a new row for the new code.
3. Do you need to eliminate codes? ☐ (check off when you have completed this)
   a. Look to the top right-hand corner, where you will click on the "Delete row" button.

☐ Watch video for 30+ seconds to understand baseline face.

☐ Code for 20 minutes.

- ☐ Take a 5-minute break. (Your breaks should be included in LS hourly report)

☐ Reacclimate yourself to baseline face through watching 15-30 seconds of video.

☐ Code for 20 minutes.

☐ Double check that you still agree with your gestalt ratings (Only need to do this once).

Reporting:

☐ Check this box if you still have more coding to finish.

☐ Check this box if you finished coding the file and marked it complete on task tracking doc.