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Communication and Language Recovery in People with Aphasia: Using Gestures in Speech-Language Therapy

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COMMUNICATION AND LANGUAGE RECOVERY IN PEOPLE WITH APHASIA: USING GESTURES IN SPEECH-LANGAUGE THERAPY

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Introduction

Hands are convenient tools. Hands can be used for daily activities, such as brushing teeth and buttoning shirts. Hands can be useful for creating beautiful artwork or writing a masterpiece. Hands can also help people communicate. According to Raymer (2007), gestures help people communicate and get their words out. Marshall (2006) stated that gestures help cue speech. Macauley and Handley (2005) emphasized that when people are unable to talk, they compensate by using gestures as an alternative way to communicate when speech is impaired.

Aphasia is a language disorder resulting from damage to the brain. Half of aphasia cases in the United States may be caused by cerebrovascular disease (CVA) (Helm-Estabrooks & Albert, 1991). There are about 500,000 people who get a stroke each year in the United States and 100,000 of those cases acquire aphasia (Helm-Estabrooks & Albert, 1991). Other causes of aphasia include traumatic brain injury (TBI), tumors, neurodegenerative disorders, and central nervous system infections (Helm-Estabrooks & Albert, 1991).

The subtypes of aphasia are divided into fluent and non-fluent aphasias (Helm-Estabrooks & Albert, 1991). People with fluent aphasias are characterized by receptive deficits but speak with correct grammar, intonation, and stress (Helm-Estabrooks & Albert, 1991). Fluent aphasias include Wernicke's, transcortical sensory, conduction, and anomic aphasia (Helm-Estabrooks & Albert, 1991). People with nonfluent aphasias typically have a reduced speech output and usually have utterances of less than four words (Helm-Estabrooks & Albert 1991). Nonfluent aphasias include Broca's, transcortical motor, mixed nonfluent, and global aphasias (Helm-Estabrooks & Albert,

1991). The main symptom of aphasia is word-retrieval difficulties (Helm-Estabrooks & Albert, 1991; Rodriguez, Raymer, & Gonzalez Rothi, 2005). The purpose of this study is to consider whether using gestures can enhance communication and language recovery in people with aphasia.

Types of Gestures

According to freedictionary.com (2013), gesture is, "motion of hands or body to emphasize or help to express a thought or feeling." There are many different types of gestures. Gestures are arbitrary and thus meanings are assigned to gestures by each person/culture. Therefore, the categories of gestures are not mutually exclusive and many of the following gestures can be categorized into more than one category of gesture. The following researchers define the following types of gestures. Emblems are symbolic gestures used in the absence of speech, such as the okay sign (Rose, 2006). Pantomime gestures involve the use of one's hands to demonstrate objects or actions in a sequential movement and are also used in the absence of speech (Rose, 2006). Gesticulations include iconic gestures, pointing, and beats (Rose, 2006). Iconic gestures include movements such as moving one's hand from side to side to indicate writing (Cocks, Sautin, Kita, Morgan, & Zlotowitz, 2009). Beats are short and fast gestures that co-occur with stressed syllables (Hadar, Burstein, Krauss, & Soroker, 1998). Filler gestures are gestures that fill time but are not related in content of speech (Macauley & Handley, 2005). Content gestures include pointing, gestures that depict movement, emblems and pictures (Macauley & Handley, 2005). Transitive gestures are gestures that show knowledge of tool use, for example, showing how to use a hammer to pound a nail into the wall with one's hands (Raymer, 2007). Intransitive gestures have communicative

intent, for example, showing how to be quiet. (Macauley & Handley, 2005). Ideational gestures are wide and complex gestures that include emblems, pointing, and iconic gestures (Hadar et al., 1998). Ferguson, Evans, and Raymer (2012) described intention/emphasis gestures as "nondominant, left-handed circular movements." Meaning-laden gestures include icons, pantomimes, and emblems (Laynon & Rose, 2009). Tompkins, Scharp, and Marshall (2006) described self-cues as spontaneous word retrieval behaviors that facilitate a person's ability to generate specific words. A co-speech gesture occurs at the same time as speech (Cocks, Dipper, Middleton, Morgan, 2010). A shape outline is a tracing gesture that depicts the shape of an object (Cocks, Dipper, Middleton, Morgan, 2010). A path gesture indicates the direction in which an objects moves (Cocks, Dipper, Middleton, Morgan, 2010).

Theories of Gestures

Theories set the foundation for gesture research. The following six theories focus on what gestures do. The Conceptual Processing Hypothesis states that gestures, with language, help constitute thought (Rose, 2006). This hypothesis states that different processes and knowledge stores in the brain are utilized depending on the type of gesture (Rose, 2006). Iconic gestures extract information from the imagery process and emblems extract information from the knowledge store of conventional shapes (Rose, 2006). Rose stated, "Gestures facilitate speaking not by directly improving access to words by rather more indirectly by reactivating visual representations in short term memory, which then assists lexical access." (Rose, 2006, p. 96). Rose makes an interesting hypothesis on how gestures help word retrieval, not directly, but indirectly.

The Lexical Retrieval Hypothesis (LRH) states that producing gestures facilitates retrieval of words from the mental lexicon (Ruiter, 2006). Therefore, gestures help the speaker retrieve the proper word form but are not communicative (Ruiter, 2006). Gestures are not used to communicate but are used to help the speaker retrieve words in their mental lexicon (Ruiter, 2006). Gesture is used most during word finding when additional information is needed to prime and access a word for production (Scharp et al., 2007). The lexical or word retrieval hypothesis states that gesture is used as a supplemental mechanism to help people facilitate their spoken language (Morrel-Samuel & Krauss, 1992).

Damasia and Tranel (1993) claimed that lesions in the inferior temporal cortex are associated with noun retrieval difficulties while lesions in the inferior frontal cortex are associated with verb retrieval difficulties. An extension of the LRH, the Neural Representations Theory argues that because nouns and verbs have different neural representations, this may mean that remediation of word retrieval difficulties may differ (Rodriguez et al., 2005).

The Communicative Intent Hypothesis argues that gestures have a direct communicative purpose (Rose, 2006). Gestures are used to send messages to communicative partners (Rose, 2006).

The Mutually Adaptive Modalities hypothesis (MAM) states that if a speaker tries to communicate spatial information in an environment with a lot of ambient noise, then the speaker will be more likely to produce gestures (Ruiter, 2006). Doing this, “aids the listener in decoding the communicative intention of the speaker” (Ruiter, 2006, p.125).

The Intersystemic Reorganization Theory states that gestures help intersystemic reorganization by using one part of the brain to facilitate increased activity in another part of the brain (Raymer, 2007). According to Raymer (2007), intersystemic reorganization is the rebuilding of speech by introducing into speaking, gestures, which were not previously integral to speaking.

The Tradeoff Hypothesis argues that when gesturing gets harder, the speaker then relies more heavily on speech (Ruiter, 2006). Then when speaking gets harder, the speaker relies more on gestures (Ruiter, 2006).

The Information Packaging Hypothesis proposes that gesturing for communication is inseparable from the verbal message (McNeill, 1992). Language and gesture are a single coordinated system that provides a multidimensional, content-rich message (McNeill, 1992).

Functions of Gestures

There are many different hypotheses and studies in regards to the functions of gestures. Many researchers claimed that gestures help word retrieval deficits in people with aphasia (Rose, 2006; Layon & Rose, 2009; Hadar, Burstein, Krauss, & Soroker, 1998; Ferguson, Evans, & Raymer, 2012; Rodriguez, Raymer, & Gonzalez Rothi, 2005; Beattie & Coughlan, 1999). Other researchers claimed that gestures replace the verbal message (Daumuller & Goldenberg, 2010; Macauley & Handley, 2005). Other researchers claim that gestures enhance communication and language recovery in people with aphasia (Raymer, 2007; Caute, Pring, Cocks, Cruice, Best, & Marshall, 2012), and that caregiver training can improve upon communicative effectiveness (Tompkins, Scharp, & Marshall, 2006; Rose, 2006).

Gestures Facilitate Word Retrieval

According to Rauscher, Krauss, and Chen (1996), the effects of preventing gesture are similar to those of word-finding difficulties. Rauscher et al. (1996) investigated typical adults who were prevented from gesturing while describing cartoon animations to listeners. The researchers found that speech with spatial content was less fluent, speech without spatial content was not affected, and the frequency of pauses in speech increased when gestures were prohibited (Rauscher et al. 1996). The researchers concluded that gestures must facilitate access to the mental lexicon (Rauscher et al., 1996). It is also possible to conclude from Rauscher et al. that the fluency of a speaker is affected by the ability to gesture and the content discussed. It appears that gestures help a speaker describe spatial content because of the fact that participants in this study were less fluent while describing spatial content. On the other hand, it appears that gesturing does not affect the fluency of the speaker while describing non-spatial content. However, the researchers made a bold inference when they claimed that people who are prevented from using gestures are similar to people with word-finding difficulties. The researchers basically claimed that a person who is prevented from gesturing is like a person with aphasia. There is no direct correlation in this study between people who are prevented from gesturing and people with word-finding difficulties. The claim that being prohibited from gesturing affects the fluency of a typical speaker is supported by this study.

Lanyon and Rose (2009) led a study that included nine females and nine males, 40-80 years of age, with single, unilateral, and left hemisphere strokes. Fifteen of the participants had non-fluent aphasia, one participant had conduction aphasia, and two participants had anomic aphasia. The method the researchers used was a naturalistic,

observational design. Participants were asked four open-ended questions, and then observed by the researchers. Verbal utterances were transcribed for non-fluent and fluent language production. The researchers found that more gestures were produced during non-fluency than during fluent speech production. The researchers also found that more gestures were produced during unresolved non-fluency than fluency. The researchers concluded that there is a positive relationship between gestures and fluency. However, that is not the case when the evidence is looked at. The participants in this study used more gestures when they were having non-fluency but it did not help them become more fluent. The more gestures used, the more non-fluency. Researchers found that the type of gesture used, meaning-laden gestures, accounted for 94% of all gesture production during non-fluency (Lanyon & Rose, 2009).

According to Macauley and Handley (2005) gestures can be used as a tool to communicate when speech is impaired. An investigation led by Macauley and Handley (2005) included 20 participants. Twelve of the participants had aphasia following left hemisphere stroke and eight participants were neurologically normal controls. The participants averaged 60 years of age. A naturalistic conversation was taped of each participant. Participants were informed after their conversation that their gestures were going to be analyzed. The participants with aphasia used four times the amount of filler gestures and two times the number of content gestures during spontaneous conversation than neurologically normals. The researchers concluded that the participants with aphasia used more content gestures to aid in communicating the intended message. Both groups of participants produced similar amounts of emphasis gestures, which led the researchers to hypothesize that people use gestures to enhance conversation (Macauley & Handley,

2005). The hypothesis that people use gestures to enhance conversation is not supported by this study due to the fact that a positive cause-effect cannot be certain based on the evidence. The term enhance conversation is a vague term used by the researchers that needs to be further defined. The researchers need to specifically define what emphasis gestures enhance. The researchers also concluded that the severity of the participants' aphasia was predictive of their gestural abilities (Macauley & Handley, 2005). The more severe the aphasia the more gestures used; be it content or filler gestures. It is not clear why the participants with aphasia used more content gestures than the neurologically normals. The researchers interpreted that the participants with aphasia used content gestures to enhance their message. Other researchers (Tompkins, Scharp, & Marshall, 2006; Rose, 2006; Ruiter, 2006; Lanyon & Rose, 2009) may infer that the participants were using the gestures to retrieve words. Laynon and Rose (2009) claimed that gestures reflect the features of speech.

Ferguson et al. (2012) compared how intention gesture treatment (IGT) and pantomime gesture treatment (PGT) affect noun retrieval in four people with aphasia. IGT consisted of participants trained to produce nonsymbolic, circular, left-handed movements while pressing a button with their right hand to view and name target stimuli on a computer. Inaccurate responses received training with hand over hand assistance. During PGT, a clinician pushed the button for the target stimuli picture on a computer for the participant to name. Inaccurate responses received training using a paired pantomime gesture while verbally producing the target noun as a model for participants. Two had Broca's aphasia, one had transcortical motor aphasia, and the last had conduction aphasia. Each participant viewed the target nouns on computer screens. This training

paired verbal and gesture stimuli to elicit verbal or gestural productions of target nouns. The results indicated that during the IGT training, verbal productions improved for two of the participants, however, verbal productions did not carry over to untrained words. The PGT training improved verbal productions for two participants and improved gesture production for three participants. The researchers found that the type of gesture had a positive association with more verbal productions and improved gesture production. Intention gestures facilitated an increase in verbal productions in participants with mild word production impairments, while pantomime gestures facilitated improved gesture production in trained and untrained word sets for participants with profound impairments. Participants also continued to use pantomime gestures one month after training.

Raymer (2007) conducted a study where 40 participants with aphasia were trained to pair a suitable gesture corresponding to a given picture, then practice words spoken and lastly pair gesture and spoken word. The independent variable was having the participants' pair gestures and spoken word when given a picture. Raymer claimed that this training would enhance oral word retrieval, however, many people in Raymer's study did not improve their oral word retrieval, although, they did improve in their ability to produce meaningful gestures. Although Raymer refuted that gestures facilitate oral word retrieval, Raymer found that the participants did use more content gestures than filler gestures; this is an important aspect of the Raymer study. Producing content gestures can be an effective way to communicate when the communication partner understands the gesture. If producing gestures is an effective way for a person with aphasia to communicate then it is important for their caregiver to be trained to the meanings of gestures produced by the person with aphasia.

Ferguson et al. (2012) and Raymer (2007) studies had many similarities. They both found that training improved the production of content gestures. They both found that gesture can be a useful means to use when communicating with a partner. Ferguson et al. (2012) and Raymer (2007) also had many differences. Ferguson et al. (2012) found that during the IGT training, participants with aphasia improved their word retrieval only on trained words and did not carry over to untrained words. On the other hand, Raymer disputes the Ferguson et al. (2012) claim that gestures facilitate word retrieval. Ferguson et al. (2012) mentioned the types of aphasia the participants had while Raymer did not mention the type of aphasia participants had. This puts in question the validity of Raymer to refute Ferguson et al. (2012), especially if the parameters of their studies were not the same.

Rodriguez et al. (2005) tested the effects of gestures on verb retrieval. One participant with transcortical sensory aphasia, two participants with conduction aphasia, and one participant with mixed transcortical aphasia were included in the study. Gesture treatment included the participants repeating a word, then producing a target gesture, followed by putting the verbal production and target gesture together. The independent variable was having the participants' pair gestures and spoken word when given a picture. Semantic-phonologic therapy included the participants repeating the target word, answering four yes/no questions about semantic and phonologic characteristics, and then repeating the target word. The results were that no participant generalized to untrained items. Three participants showed significant improvement on trained items in semantic-phonologic therapy, while one participant showed improvement on trained items in

gesture therapy. The gesture therapy was not superior to semantic-phonologic therapy for verb retrieval.

Hadar et al. (1998) led a study that included eight patients who received rehabilitation after a stroke. The participants were divided into two groups, four patients with anomic aphasia and four patients with visual and spatial deficits but not aphasia. The participants were filmed while describing a picture. The results indicated that the participants with anomic aphasia produced more ideational gestures than those with visual and spatial deficits. The researchers concluded that gestures facilitated word retrieval by "feeding the conceptual system with proprioceptive and kinaesthetic information" (Hadar et al., 1998, p 74). Hadar et al. (1998) concluded that gestures facilitate word retrieval but their research did not indicate this. This study did not measure word retrieval with and without gestures; instead, it compared the frequency of gesture use by people with anomic aphasia as opposed to those with visual and spatial deficits. People with anomic aphasia tend have difficulty remembering words for objects even though they may know what the object is used for. Because of this they may use circumlocutions when speaking or use gestures to demonstrate the function of an object. This may be why in this study the participants with anomic aphasia used more gestures than participants with visual and spatial deficits.

The tip of tongue state (TOT) is when a person is sure of the word but is momentarily unable to find it (Beattie & Coughlan, 1999). Beattie and Coughlan led a study where they induced TOT states 32 in participants with no impairments by presenting participants with definitions and then asked which word was described. Half of the participants were allowed to gesture and the other half were not allowed to gesture.

The researchers hypothesized that the participants allowed to gesture would resolve a higher number of TOT states than the participants who did not gesture. This is not what occurred. The participants who gestured actually had a lowered probability of resolving TOT state than participants who did not gesture. Laynon and Rose (2009) found that more gestures were produced during word retrieval difficulties than during fluent language production but there were also more unresolved word retrieval events than resolved. According to the LRH, the participants who gestured should have been retrieving the word from their mental lexicon (Ruiter, 2006). The Beattie and Coughlan (1999) study and Laynon and Rose (2009) study disprove that gestures resolve TOT states and refutes the LRH that gestures facilitate word retrieval.

Gestures Replace the Verbal Message

Daumuller and Goldenberg (2010) led a study where all participants had severe aphasia after a left-hemisphere stroke. Most participants had limited verbal expression and right-sided hemiplegia. The researchers only indicated the difference between the types of aphasia as “severe” and “very severe” (Daumuller & Goldenberg, 2010, p. 64). Twenty-five participants with aphasia were included in the therapy group while 10 participants with aphasia were included in the control group. Participants in the therapy group were taught 24 communicative gestures, such as drinking, reading, and writing. The participants in the control group were tested on all gestures but did not receive gesture therapy. Rate of improvement for practiced gestures for the therapy group reached maximum values. Repeated testing of gestures for the control group did not yield a significant statistical difference, meaning that gesture usage did not improve upon multiple examinations. Therapy was found to improve practiced gestures, however,

practiced gestures did not generalize to unpracticed gestures. Daumuller and Goldenberg found that people with severe aphasia can acquire intelligible gestures for replacing speech. The Daumuller and Goldenberg (2010) study shows that people with severe aphasia can learn to use gestures to communicate but that participants with very severe aphasia benefited less from therapy than those with better linguistic capabilities. The effectiveness of gesture therapy appeared to vary dependent on the severity of the aphasia.

Helm-Estabrooks, Fitzpatrick, and Barresi (1982) conducted a study with eight participants with global aphasia. These participants had not responded to other treatments. Visual Action Therapy (VAT) was given to the participants. VAT trained participants with poor verbal skills to use gestures for functional communication. Individuals who are candidates for VAT include: a left-hemisphere stroke, severe aphasia with difficulty producing spoken and written language, limb or oral apraxia, ability to produce learned gestures, and an ability to perform cognitive tasks such as memory and visual perception. The participants greatly improved on the post-test on the Porch Index of Communicative Ability (PICA). PICA measured pantomimic and auditory comprehension skills. Participants did not improve upon verbal expression but researchers thought this was due to oral apraxia. Individuals with limb apraxia have difficulty making precise movements with their arms or legs and therefore do not seem appropriate candidates for VAT. VAT was effective for increasing use of pantomimic gestures and auditory comprehension for the eight participants in this study but it needs to be further researched on a wider population.

Gestures Enhance Communication and Language Recovery

Caute et al. (2012) led a study that included 14 people with severe aphasia who also had either limb or oral apraxia. All participants received Therapy A, which included 20 gestures for 20 different words starting at recognition tasks and progressing to production tasks. Seven participants received an additional Therapy B while seven participants received no further therapy. Therapy B was aimed to develop the participants' interactive use of gesture with a communication partner. All participants were assessed pre and post therapy with message assessment and narrative assessment. Message assessment consisted of the participants conveying simple messages to their communication partners using gesture or speech. Narrative assessments consisted of the participants watching a silent video with ten linked events and then conveying the contents to their communication partner. The results of the message assessment and the narrative assessment were the same, and demonstrated a significant difference between baseline and post therapy scores. Therapy B was found to improve performance on two novel tasks; participants demonstrated a statistically significant difference in their ability to convey information to their partners after Therapy B. After Therapy B the participants were more willing to attempt a gesture or a word than they were at baseline. Lastly, Caute et al. (2012) found that the communication gains made by the participants crossed over to untrained items. The message assessment appears to be like the game charades. In this game, players have to act out the message without using words. Like charades, some people are simply more natural at gesturing than others. Important information to find out is whether gestural training can improve a person's use of gestures and whether the communication partner can interpret the message correctly. The Caute et al. (2012) study

shows that gesture usage can be improved upon by gesture therapy. Caute et al. (2012) did not state how they measured participants' willingness to use gestures or words. The researchers cannot simply state that the participants were more willing to attempt a gesture or word after therapy B without data to support it.

Communication Partner Training Enhances Communicative Effectiveness

Rose (2006) stated that even though gesture production therapy may not be useful for some people with aphasia, it can be useful for the communication partner to use gestures, "as an aid to enhancing message comprehension for the person with aphasia" (Rose, 2006, p. 107). Rose did not have evidence to support this statement.

Tompkins et al. (2006) conducted a study where participants viewed a videotape of patients with aphasia responding to a 100-item single-word speaking task. Six typical adults viewed the videotape and were split into two groups of three. The control group was told that the videotape displayed adults with aphasia who were attempting to speak; the control group then guessed what they were attempting to say. The context group had the same task as the control group, but in addition was given an explanation of word finding difficulties in people with aphasia. The context group had a higher percentage (56%) of accurate guesses than the control group. The investigators concluded that observers can glean intended meaning from self-cues and that giving context to observers helps them interpret self-cues with better accuracy. The study also found that pantomime and location gestures produced by the person with aphasia equaled the most accurate observer judgments. Tompkins et al. (2006) tested how typical adults interpret gestures of people with aphasia. Tompkins et al. found that communicative effectiveness can be improved upon by educating caregivers of people with aphasia about aphasia and word

finding difficulties can help the caregiver better understand what the person with aphasia is trying to say. It is important to note that the type of gesture can help a caregiver more accurately understand the message. Therefore, it is possible that the type of gesture used effects whether the message is understood.

Conclusion

Rauscher et al. (1996), Ferguson et al. (2012), Macauley and Handley (2005), Raymer (2007), and Hadar et al. (1998) are all studies that found positive association between gestures and word retrieval. Rauscher et al. (1996) found that participants used gestures more frequently when discussing spatial content. Ferguson et al. (2012) found that gestures facilitated improved gesture productions and an increase in verbal productions. Macauley and Handley (2005) found a correlation that gestures are used to enhance conversation. Raymer (2007) concluded that the participants improved in their ability to produce meaningful gestures. The difficulty with this statement is explaining what meaningful gestures are. There is no operational definition for a meaningful gesture and thus each researcher may have their own definition. Hadar et al. (1998) found that people with anomic aphasia may benefit more from gesture therapy than people with visual and spatial deficits.

Rodriguez et al. (2005), Laynon and Rose (2009), Beattie and Coughlan (1999) are studies that refuted the hypotheses that gestures facilitate word retrieval. The Rodriguez et al. (2005) study came to the conclusion that gesture therapy was not better than semantic-phonologic therapy for people with aphasia for verb retrieval. The Laynon and Rose (2009) study resulted in participants using more gestures while having word finding difficulties but this resulted in less retrieval of words. The Beattie and Coughlan

(1999) study resulted in participants not resolving their TOT state by gesturing and the participants actually had a lower probability of resolving their TOT state then the participants who did not gesture. The Beattie and Coughlan (1999) study also supported the findings of the Laynon and Rose (2009) study.

The Daumuller and Goldenberg (2010) and Helm-Estabrooks, Fitzpatrick, and Barresi (1982) studies supported the hypothesis that gestures can replace the verbal message. Daumuller and Goldenberg (2010) found that people with aphasia can learn to use gestures to communicate. Macauley and Handley (2005) found that people with aphasia used gestures with verbal productions to aid in communicating the intended message. Helm-Estabrooks, et al. (1982) found that VAT was an effective treatment for training an individual with global aphasia to communicate. Daumuller and Goldenberg (2010) used a therapy that taught 24 communicative gestures. These gestures could be used alone to request wants like a glass of water. The difficulty with using gestures alone is that gestures can only be used up to a certain extent; people cannot have a conversation using gestures alone.

Caute et al. (2012) supported the hypothesis that gestures enhance communication and language recovery in people with aphasia. They found that participants used more gestures after therapy. This may mean that participants found that using gestures was useful and effective in communicating their message.

The Tompkins et al. (2006) study supported the hypothesis that caregiver training enhances communicative effectiveness. These researchers found that caregiver education about aphasia and word finding difficulties improved the communication partners understanding of the message produced by the person with aphasia.

Rodriguez et al. (2005), Daumuller and Goldenberg (2010), and Ferguson et al. (2012) all found that the participants who received gesture therapy improved on trained gestures but participants did not generalize this to untrained items. This may mean that people with aphasia need to be trained how to use each gesture and the therapist should include gestures that pertain to the client's life. This may also mean that the studies conducted were using a non-effective gesture therapy and a different, more effective gesture therapy needs to be explored. Caute et al. (2012) found that their participants did generalize their gestures after therapy and even used more gestures after therapy. Caute et al. (2012) paired gestures and words for therapy, however, so did Rodriguez et al. (2005). Therapy was similar but the results were different.

The type of gesture used appeared to affect the outcomes of certain studies. Pantomimes were found to be more effective in retrieving words, (Laynon & Rose, 2009), improve gesture production in trained and untrained words, (Ferguson et al., 2012), and help the communication partner better understand the message (Tompkins et al., 2006).

There are limitations to gesture research. One limitation of gesture studies includes the fact that there is no one, universal operational definition of gesture. There is no single system that identifies what counts as a specific type of gesture. When researchers are left to define what gestures are, the line can get fuzzy. One researcher defines an icon as an ideational gesture (Hadar et al., 1998) while another researcher defines an icon as a meaning laden gesture (Laynon & Rose, 2009). Another limitation of gestures is that they are arbitrary. Gestures are not universal. Gestures have different definitions in different countries. For example, sticking the middle finger up means a bad

word in the United States but in Japan sticking the middle finger up does not mean anything. Another limitation was the types of research studies found. Many studies were found discussing whether gestures facilitated word retrieval difficulties in people with aphasia. It was difficult to find studies that included other topics concerning gestures even though there appears to be many hypotheses on the functions of gestures. There are also many conflicting theoretical hypotheses on what gestures do and this has developed because there is no objective measure to quantify the temporal dynamics of gesture (Scharp et al., 2007). Another limitation is the appearance that the interpretation of the results of these studies appears to be based on researcher bias. Macauley and Handley (2005) interpreted the results of their study by claiming that the participants used gestures to enhance the message while other researchers would interpret the results otherwise. There is room for interpretation because researchers could not see into the participants' brains to see what was really occurring.

Gesture research findings based on correlations and future research needs to be conducted to find out if there is a direct cause and effect relationship between gesture and language. Future research with functional magnetic resonance imaging (fMRI) may be an objective tool that may leave less room for researcher bias. Future research is needed for gesture treatments beyond noun and verb retrieval. Little research has covered how gesture might be used at the sentence and discourse levels. The type of aphasia that may benefit the most from gesture therapy needs to be identified. Future research is needed to establish the efficacy of gesture treatment in aphasia. Ferguson et al. (2012) suggested that further research should be conducted comparing IGT and PGT for verb retrieval in individuals with aphasia because "verbs and gestures both represent movement concepts,

and nouns and verbs differ in neural representation" (Ferguson et al., 2012, p. 136). A collaboration of speech-language pathologists, cognitive scientist, and neurologists need to occur in order to understand the complex interactions of gesture, speech, language, and cognition.

Principles for Clinical Reasoning

In summarizing the evidence reviewed in this article, the following points are tentative principles for consideration when thinking about gesture therapy for people with aphasia.

1. Observe gesture comprehension.
2. Videotaping the patient gesturing can be useful to view later for more careful analysis.
3. Bear in mind the types of gestures that are produced by the patient; gesticulations, pantomimes, emblems.
4. Bear in mind the functions the gestures are playing in the life of the patient. Do the gestures that are used have a communicative purpose?
5. Bear in mind that co-morbid deficits may impact a patient's ability to learn to use gestures.
6. Be sure to model gesture production and encourage the patient to use their hands to communicate.
7. Include significant others in gesture-based therapy.

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