DEVELOPMENT OF VERB GESTURE CORPUS

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A Dissertation Submitted in Part Fulfilment for the

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CERTIFICATE

This is to certify that this dissertation entitled "**Development of Verb Gesture Corpus**" is a bonafide work submitted in part fulfilment for the Degree of Master of Science (Speech Language Pathology) of the student (Registration No: 17SLP004). This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier for the award of any other Diploma or Degree to any other University.

Mysuru

May, 2019

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CERTIFICATE

This is to certify that this dissertation entitled "**Development of Verb Gesture Corpus**" has been prepared under my supervision and guidance. It is also certified that this has not been submitted earlier for the award of any Diploma or Degree to any other University.

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DECLARATION

This is to certify that this dissertation entitled "**Development of Verb Gesture Corpus**" is the result of my own study under the guidance of Dr. S P Goswami, Professor, Department of Speech Pathology and Head - Tele-Center for Persons with Communication Disorders, All India Institute of Speech and Hearing, Mysuru and has not been submitted earlier for the award of any Diploma or Degree to any other University.

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CHAPTER I

Introduction

Communication refers to the process of sharing information between two or more persons, or more specifically, "the transmission of thoughts and feelings from the mind of a speaker to the mind of a listener" (Raphael, Borden & Harris, 1994).Person who forms the message into a format appropriate for communication is called sender and the person who receives the message and transforms it into the format for understanding the meaning is called receiver. Sender and receiver are together called the players of communication.

Communication is broadly divided into verbal and nonverbal counterparts. The use of spoken language for sending a specific message is referred to as verbal communication (McDuffie, 2013). Human language is an important aspect of verbal communication which is a system of symbols along with rules called grammar constitute human language. If communication has happened not explicitly through spoken words, then it is referred to as non verbal communication.(Hess, 2016). Under the assumptions that 'one cannot not communicate' (Watzlawick & Beavin, 1967) and that all movements are expressive to some degree (Wiener, Devoe, Rubinow & Geller 1972), all nonverbal behaviors are considered as nonverbal communication. Haptic communication, gestures, body language, facial expressions, and eye contact are a few examples of nonverbal communication.

Gestures

Gestures are defined as manual [e.g., waving arms to say goodbye], facial [e.g., drooping of lips to show displeasure], or other body movements [e.g., mimicking an object or person] (Capone, 2010). It is noticed that humans of all ages, cultures, and backgrounds make use of gestures when they speak (Kelly, Manning & Rodak, 2008). Gestures are used for meaningful communication. When a speaker is speaking, s/he gestures and talks simultaneously. McNeill (1992) reported that gestures are highly integrated with speech and that they help in language comprehension and production.

Kelly, Ozyurek and Maris (2010) consider speech and gesture are like two faces of a coin since both gestures and speech enhances comprehension. For the ease of understanding, gestures are classified into various types. McNeill (2005) classified gestures into four broad categories based on its structure and content. They are iconic gestures, metaphoric gestures, deictic gestures and beat gestures. Iconic gestures are those gestures in which an action or an event is described by the form of gesture. Metaphoric gesture comprises of common metaphors, and the concept it represents does not have any physical form. Deictic gestures are gestures that depict the actual location or physical entities. Beat gestures serve a pragmatic function and can occur along with a speech like a hand movement to emphasize important points. Whereas Nehaniv (2005) classified gestures into five categories: Irrelevant gestures (neither communicative nor socially interactive, but are the effects of human motion), side effect of expressive behavior (like motion of hands while speaking), symbolic gesture (conversationalized signal in communication), interactional gesture (used to regulate interaction with partner) and referential gesture (used to refer to an object). Gestures can also be classified as transitive and intransitive gestures. Transitive gesture refers

to the object-related actions like hammering, and intransitive gesture refers to the gestures which have nothing to do with objects, and carry communicative content like waving goodbye (Carmo & Rumiati, 2008).

With reference to communication, gestures have various functions such as providing additional information compared to the language content (Goldin-Meadow, 2003), providing same meaning as that of language content (Shovelton, 2000), providing alternate means of communication (May, David & Thomas,1988), manipulating the control on the flow of the speech (Jacobs & Garnham, 2007),facilitating lexical retrieval (Mayberry & Jaques, 2000) and helping in sentence re-construction (Alibali, Kita & Young,2000)

Gestures also have a neural basis. Gestures are incorporated in various components of language and they show overlap with some parts of language components, especially with speech.Taking neural basis into consideration, the gesture is found to be lateralized in the left parietal lobe mediated through the visual-motor system. It is different from actual actions being performed using real objects. Thus, gestures are not just motor movements but are symbolic and are closely linked to and derive source from the language system. According to a Moll, De Oliveira-Souza, Passman, Cunha, SouzaLima, and Andreiuolo (2000) an overlap can be seen in gesture and speech neural representation in the inferior frontal cortex, Broadman's Area number 45.Kelly, Kravitz, and Hopkins (2004) in an ERP study used N400 revealed that hand gestures and speech mightbe integrated at early and late stages of language processing. Neuroimaging studies by Montgomery, Gobbini and Haxby (2003) revealed that object-directed movements of body parts particularly that of hands had stronger activity both in the areas of motor behavior (cerebellum, putamen and premotor cortex) and social cognition (anterior STS, temporal pole and medial

prefrontal cortex). For action recognition (as part of a "mirror" or "observation-execution matching" system) and in semantic retrieval or selection (as part of a language comprehension system), Broca's area plays an important role (Skipper, Goldin-Meadow, Nusbaum & Small, 2007). Yang, Andric and Mathew (2015) in their meta-analysis revealed that hand movements and gestures are cued up perceptual - motor network as meaningful symbols and by semantic network for conceptual processing. A network for social emotive processes is responsible for face to face interactions and gestures. Their findings also indicated the influence of brain networks during gesture comprehension. Thus, the neural evidence supports the gesture and the language link and existence of an interaction between the two modalities.

There are two schools of thought when it comes to the relationship between gestures and speech. One group of authors believes that gestures and speech are independent of each other. Krauss, Chen, and Gottesmann (2000) who opined that gesture and speech are independent gave a model called lexical facilitation model, which assumes that gestures are generated purely from imagery and the gestures facilitate retrieval of meaningful words. There is another group of authors who opine that gestures and speech are integrated and not independent. The speech production model is given by Krauss, Chen, and Chawla (1996) served as a base for all the models that support interception. Gesture production is considered as a system that is parallel to speech production and interacts with speech production at various language processing levels. According to growth point theory (McNeill, 1992; McNeill & Duncan, 2000), the sketch model (De Ruiter, 2000) and the interface model (Kita and Özyürek, 2003) gesture and the speech are integrated. Growth point theory talks about a holistic representation which contains both imagistic and symbolic information. Production of an utterance is described as a Growth Point "unfolding" into separate

symbolic and imagistic components, and during speech production, the symbolic part of a Growth Point is turned into speech, and the imagistic part into a gesture. The sketch model talks about the production of speech in combination with all types of gestures, except beats. The model assumes that both a gesture and the speech it accompanies have a communicative function and they originate from the same communicative intention. The interface model believes that the availability of words for expressing a certain concept affects the gesture that accompanies a speech that is expressing that concept. The model also says that there is a relationship between the type of gesture and the clausal structure of manner–path combinations of a language. Thus, the model proposed that the process of speech generation and the process of gesture generation interact with each other, or may operate in a way orienting to have a result of similar information.

Need For the Study

There is growing evidence to support gestures being synchronized to verbal language and tightly integrated. The importance of gestures in communication sciences across development, learning, assessment, and therapeutics is obvious. There is a dearth of literature on theuse of the gestural form for the same. This study is planned to combat the very situation and develop the gesture corpus for the set of verbs which forms a prime part of the linguistics. There is a need to generate, validate the gesture corpus and classify them into types as idiosyncrasies in gesture production across individuals could be present.

Verbs and gestures. Verbs form the major part of the verbal language which describes an action, state, or occurrence. It is the major part of the sentence, i.e. the predicate, and helps in understanding the meaning of the sentence and is extensively

used in everyday conversation. It is also evident that verbs are the major part of action language (signs and gestures) which is represented holistically. However, there are limited validated verb gestures available for professionals to be used for clinical and research purposes. Thus, we need to build a corpus in this area keeping the ethnocultural perspectives.

Aim of the Study

To develop and validate a corpus of gesture for verbs.

Objectives of the Study

- To develop a corpus of gesture for verbs.
- To validate the gesture corpus.
- To classify the gestures across types for the set of verbs.

CHAPTER II

Review of Literature

Development of gestures

Developmental studies have either shown gesture milestones to be preceding the speech milestones or simultaneous development. Capone and McGregor (2004) and Goldin-Meadow (2015) have described the typical gesture development in infants. They have recorded that deictic gestures develops by 10 months. By 9-13 months ritualized requests i.e. grasping motion towards the desired object, adult's hand position on desired object, pulling adult's hand towards the desired object develop. Play schemes i.e. actions carried out on an object that demonstrates the object's function (e.g. drinking out of a toy cup) develops by 12 months. Iconic gestures develop before a child has acquired 25 words. Gesture and speech combination is acquired by 18 months. Complimentary gestures containing information about the spoken message are developed at initial stages. For example, hands pointing towards a dog and saying "dog". Later, supplementary gestures providing additional information will develop. For example, hand pointing towards a dog and saying "big".

It is observed that speech and gestural modalities are not well integrated at the time of birth. In a study by Veena and Rajshekar (2013), eight 8-months-old children were followed up until the age of 18 months and were checked for mother-child interactions and were analyzed for gestures. It was found that children begin to produce meaningful gestures by ten months, following which the acquisition of meaningful words take place. (Bates, 1976; Bates, Benigni, Bretherton, Camaioni & Volterra, 1979; & Veena, 2010) . Fogel and Hannan (1985) in a study observed 28

full term and healthy infants of 9 weeks during a 2 minutes face to face interaction with the mother. They concluded that the manual actions of infants of that age may occur in relation to their facial expression, gaze direction and vocalization**.** In similar lines, Ejiri (1998) and Iverson & Fagan(2004) noted that children as young as three months old exhibit systematically sequenced vocalizations with facial actions, hand gestures, etc.

Various studies have documented that gestures pave the way for the development of language. In a study by Iverson and Meadow (2005), it was seen that most of the children use gestures before speech for the purpose of communication. In this study, 10 children who were making the transition from single words to two-word combinations were considered in this study. It was found that the number of lexical items the child produced was higher in the case of the children who produced gestures and then moved on to speech, in comparison with the children who directly used speech. Also, it was noted that the children who were first to use the gestures were the first to use a combination of two-word phrases. A study by Masur (1982) examined mothers' responses to three object-related gestures (pointing, extending objects, and open-handed reaching). The participants were mothers of the infants of the age range 9 months to 1.6 years. The study concluded that the mother’s response to the infant’s object related gestures is a predictor of the lexical development of the child. On analyzing, it was revealed that the mothers responded differentially to their infant's pointing gestures, reciprocating to a greater degree with labels of the indicated objects and also, the mothers' labeling responses to pointing significantly predicted the extent of their children's object-naming vocabularies.

Gestures across different disorders

According to various studies, gestures are affected by presence of different disorders like apraxia, dementia, autism, aphasia, etc. It is important to know about the type and degree of the effect these disorders have on the comprehension and production of gestures.

Gestures in Apraxia

Initially,gesture deficit was thought to be the product of apraxic movement disorder. Duffy and Duffy (1981) showed pantomime deficits in the presence of limb apraxia. Persons with Apraxia who had posterior lesions were found to have more difficulty in comprehending the meaning of pantomimes and persons with anterior lesion had difficulty in producing the pantomimes. This finding was replicated by Rothi, Heilman & Watson (1985) where a nonverbal paradigm was used in which the subjects did not have to discriminate between gestures, but instead had to comprehend their meaning. Pantomimed acts on videotape were shown to six persons with apraxic-aphasic, seven persons with nonapraxic-aphasia, and six normal subjects. Subjects responded by pushing a button corresponding to the desired picture. It was noted that the apraxics made more errors than the aphasics or controls. From the mentioned studies, it is evident that persons with apraxia have deficits in comprehension and expression of gestures and the deficit depends on the type of apraxia.

Gestures in Schizophrenia and Dementia

On the other hand, in persons with Schizophrenia (Grüsser, Kirchhoff and Naumann, 1990) and Alzheimer's disease (Mountjoy, Rossor, Iverson & Roth.

1984; Terry, Peck, Theresa, Schechter & Horoupian, 1981) difficulties in comprehension and recognition of gestures is seen but the primary deficit here is regarded to be more at the conceptual level of language processing. A few reports this difficulty to be present due to impairment in imitation may be linked to difficulties in generating and maintaining internal representations in working memory.

Matthews, Gold, Sekuler and Park (2011) attempted to check for gesture imitation in persons with schizophrenia and age-matched healthy controls using two experiments, where the participants imitated single gestures and they imitated sequences of two gestures, either while viewing the gesture online or after a short delay that forced the use of Working Memory. In the first experiment, imitation errors were more in number in persons with schizophrenia in comparison with healthy controls. A significant interaction was noticed between imitation ability and working memory was seen in the second experiment. Persons with schizophrenia produced more errors. They required more time to imitate compared with healthy controls when imitation depended upon working memory. Moreover, impaired imitation from working memory was significantly correlated with the severity of negative symptoms but not with positive symptoms. It was concluded that gesture imitation was impaired in schizophrenia, especially when the production of an imitation depended upon working memory and when an imitation entailed multiple actions.

Walther, Stegmayer, Sulzbacher, Vanbellingen, Müri,Strik and Bohlhalter (2015) in their study attempted to test whether impairment in gestural knowledge, gesture performance or motor abilities are related to poor non verbal social perception. In their study, forty-six persons with schizoaffective disorder and forty-four age, gender, and education matched healthy controls. Non verbal communication tasks such as gesture performance, gesture recognition and non verbal social

perceptions were performed by the participants. Comprehensive clinical and motor assessments were carried out on all participants. It was observed that non verbal communication task presented by all the persons with schizophrenia was impaired compared to that of the control. The study also confirmed a generalized non verbal communication deficit in persons with schizophrenia.

Parakh, Roy, Koo and Black (2004) designed a study to investigate the relationship between the performance of limb gestures and the severity of Alzheimer's disease. Apraxia tends to occur at later stages of Alzheimer's disease, and the severity of apraxia has been shown to vary with the severity of Alzheimer's disease dementia. Participants included9 with no cognitive impairment, 10 with mild impairment and 18 persons with moderate Alzheimer's disease along with 25 controls. The tasks of the participants were to pantomime or imitate (both concurrent and delayed), eight transitive gestures to assess praxis performance. The study has indicated a dependence of severity of Alzheimer's disease on performance of imitation tasks.

Different studies indicate that persons with Schizophrenia and Dementia have deficits in comprehension and expression of gestures and the deficit depends on the severity of the disorder.

Gestures in Hearing Impairment

Obermeier, Dolk, and Gunter (2012) assessed for the benefit of gestures during communication in hearing-impaired individuals using Event Related Potential experiments. In this study 16 persons with hearing impairment ranging from mild to profound degree along with 16 age matched healthy controls were considered. They were asked to view and interpret gesture videos where an actress read aloud sentences

embedded in noise as well as in absence of noise. The gesture disambiguated the homonym present in the sentences. In this study, considerable speech gesture integration and disambiguation at the target words are observed in persons with hearing impairment. The study concludes that the gestures are beneficial in difficult communication conditions in both, external factors like noise or internal factors like hearing impairment.

In a study by Ambrose (2016) an attempt was made to understand use of gesture in toddlers with hearing loss with emphasis on mothers' responses as well. 25 toddler-mother dyads with toddler having hearing impairment were considered for the study. 23 toddler-mother dyads with toddlers having normal hearing sensitivity were considered as control. In their study, a video was recorded for a duration of 30 minutes for each mother-toddler interaction. The interactions were transcribed into gesture use, sign and spoken language and subsequently toddlers' gestures and mothers' responses were coded. The mothers were asked to give a report on toddlers' spoken language and gestural abilities. It was observed that toddlers having hearing loss had shown delays in spoken language but they are par with normal hearing toddlers as far as gesture is considered. This indicated that for toddlers with hearing impairment spoken language ability depends on hearing level, but gesture ability does not. The study reflected the importance of training to increase mothers' provision of contingent feedback as they are not so responsive in case of toddlers having hearing impairment since those mothers are not so responsive compared to the mothers of normal hearing toddlers.

In a study by Zamani, Weisi, Ravanbakhsh, Lotfi and Rezaei (2016), auditory-verbal and gesture combination training for verb production in children with severe hearing loss were carried out. In this study, they had selected 66 children with hearing

loss and randomly grouped into two groups, each having 33 children. One group was considered as experimental group and the other as control group. Receptive and expressive language competence was evaluated by the standard tests for some simple verbs of Persian language. The selected verbs include 50 simple early action words like sit, run, hold, go, etc. The intervention group with children having hearing impairment had been given the "Auditory-Verbal and Gestural" combination therapy where as the control group had been provided with only "only Auditory-Verbal" therapy. This study showed significant difference in receptive response of the selected simple verbs in both experimental and control groups after the intervention. Before intervention, there was not much difference in receptive scores between two groups. However, between the two groups there was a significant difference in mean receptive scores after the intervention. In 2-3-year-old children with severe hearing loss, there was a significant change in the mean expressive score when gestures were added to Auditory Verbal Therapy. But, both the synthetic approach and the Auditory Verbal Therapy had the same degree of positive effect for the education of receptive language of simple verbs for these children.

It can be concluded that gestural abilities are not compromised and can be used during the intervention to facilitate learning.

Gestures in Autism Spectrum Disorder

Hobson (1986a, 1986b) reported that children with autism have impairment in understanding emotions conveyed through gestures. They show gestural communication to a lesser degree when compared to other typically developing children and children who showed developmental delays (Medeiros & Winsler, 2014; Bono, Daley, & Sigman, 2004). Colgan, Lanter, McComish, Watson, Crais and Baranek (2006) analyzed social interaction gestures in infants with autism. This study

analyzed the emergent use of gestures used among 9–12-month-old infants with autism and typical development using retrospective video analysis and examined the frequency, initiation, prompting, and diversity of types of gestures used for social interaction purposes. Decreased variety was found in the type of gestures were used by children with autism.

Mastrogiuseppe, Capirci, Cuva and Venuti (2015) aimed to document the total number of gestures as well as specific gesture types used by children with Autism Spectrum Disorder during naturalistic interactions with their mothers. A specific Autism Spectrum Disorder gesture profile was determined by comparing this information with gesture use by children with Down's syndrome and typically-developing children. The children in the study were at approximately a 24-month-old developmental level. Data regarding the children's gesture use was collected and videotaped during 10-minute play sessions with their mothers. All gestures produced by the children were coded and categorized. It was observed that children with Autism Spectrum Disorder produced a lower total number of gestures, used fewer iconic gestures and produced significantly fewer pointing gestures and showing gestures. They also reported that children with Autism Spectrum Disorder used a significantly higher proportion of ritualized requests, produced fewer "nominal/partner" gestures. Nominal gestures are made with the object or referent in hand and provide a label for the object. Nominal/partner gestures involve the ability to engage a partner in play when the child performs an action on the partner's body (e.g. child brings a toy apple to her mother's mouth to let her eat). It was also noted that children with Autism Spectrum Disorder produced "instrumental gestures" and referred instrumental gestures to contact gestures where the child directly manipulates the partner's hand/body and uses it as a tool (e.g. place mother's hand on a container

the child wants to open). The authors found that the other two groups of children did not produce instrumental gestures.

In summary, various studies have shown that children with Autism Spectrum Disorder produce a reduced variety of gestures and produce types of gestures that are atypical in normally developing children.

Gestures in Down syndrome

Numerous studies have documented that gestures in children in Down syndrome are in par with typically developing children and they use gestures to compensate for the hurdle they come across in spoken language(Iverson, Longobardi, & Caselli, 2003; Zampini, 2008; Zampini & D'Odorico, 2011). Whereas according to Mastrogiuseppe et. al., (2015), children with Down syndrome produced more showing gestures than children with typical development. The authors hypothesize that the older chronological age of the children with Down syndrome may have contributed to this result. This finding was supported by Caselli (1990).

Gestures in Aphasia

The first thought with respect to gestures in aphasia is that are gestures available for persons with aphasia. Uses of gestures in severe aphasics were noted by Goodwin (1995) and Parr (2007). The study conducted by Parr considered 20 persons with severe aphasia following stroke and documented environments, protagonists, events, and interactions. Out of twenty, one of the persons with aphasia exhibited gestures for enhancing his communication and improving the comprehension of the message by the communication partner.In similar lines, Wilkinson, Bryan, Lock and Sage in a case study in 2010 documented that gestures aid in aphasic conversation.

Gestural studies across aphasia have reported persons with aphasia to be better in gesturing than speech (Marshall, Atkinson, Smulovitch, Thacker & Woll 2004). A study by Dipper, Pritchard, Morgan and Cocks (2015) which explored the connection between language and gestures in 29 persons with aphasia, documented that gestures augment discourse in aphasia. The task that was administered was retelling the story of a cartoon video. Also in similar lines, a study conducted by Sekine and Rose (2013) revealed the same. This study included 98 individuals with aphasia and 64 typical controls and used the task of story retelling. It was observed that a significantly higher proportion of individuals with aphasia gestured as compared to typical controls, and for many individuals with aphasia, this gesture was iconic and was capable of the communicative load. Aphasia type impacted significantly on gesture type in specific identified patterns, detailed here. They concluded saying that the type-specific patterns seen in persons with aphasia suggest the opportunity for gestures as targets of aphasia therapy.

In a study by Lanyon and Rose (2009) where they attempted to investigate the possible facilitation effects of spontaneously generated arm and hand gestures during word retrieval difficulty in people with aphasia, it was concluded that gestures help in word retrieval in aphasics. In this study, 18 persons with chronic aphasia were considered as participants and 20 minutes long conversational samples were acquired from them which were assessed for different types of gestures. It was observed that gesture production was significantly higher during instances of word retrieval difficulties. The resolution of word retrieval difficulty was significantly more frequent with a gesture present.

The second thought that rises with respect to aphasia and gestures is if gestures are always available in aphasia.

In a study by Gainotti and Lemmo (1976) one hundred and twenty eight persons with unilateral hemispheric damage out of which 53 were Persons with Aphasia, 26 were nonaphasic left, and 49 were right brain-damaged; and 25 normal controls were given a test of symbolic gesture comprehension and other tests of verbal comprehension and of reproduction of symbolic gestures. On the test of symbolic gesture interpretation, persons with aphasia performed significantly worse than any other group of persons with brain-damaged. Within the persons with aphasia, the inability to understand the meaning of symbolic gestures was highly related to the number of semantic errors obtained at a verbal comprehension test. On the other hand, only a mild relationship was found between comprehension and reproduction of symbolic gestures. Wang and Goodglass (1992) also found similar results for formal gesture elicitation tasks where people with aphasia typically score below healthy and Right Hemisphere controls.

Duffy and Duffy (1981) and Duffy and Watkins (1984) observed that tasks that require both production and comprehension of gesture may be impaired, and gesture scores may be related to language scores.

Mol, Krahmer and Sandt-Koenderman (2013) studied 25 people with aphasia and 17 non aphasic controls who were asked to communicate in two scenarios (buying a sweater and a road accident). The dialogue was scored by different raters and was coded for gestures. Gesture skills may outstrip language skills in aphasia, and gesture may be often used to support communication. However, skills with gesture cannot be assumed, performance on gesture tasks may be impaired relative to controls and some people with aphasia do not exploit the full potential of gesture.

Usage of gestures in therapeutic intervention for Aphasia. Gestures have are being used in speech-language intervention, especially in naming treatment. Khanna and Manjula (2003) have reported gestural priming over phonological priming aid in word retrieval in neurotypical adults. In similar lines, Rodriguez, Raymer, and Rothi (2006) reported positive effects of usage of gesture along with Verbal treatment for verb retrieval in an individual with a moderate phonologic retrieval impairment for verbs.

Gesture therapy can be provided to enhance speech production. Marongolo, Bonifazi, Tomaiuolo, Craighero, Coccia, Altoè, Provinciali and Cantagallo (2010) considered six persons with aphasia in their study (4 nonfluent and 2 fluent). The task involved was observation and execution of actions over a period of two weeks. Naming the video clips of actions was considered as an outcome measure. They reported of significant benefit for nonfluent speakers when gestures were used for therapy. They also reported of equal benefits from action observation and execution.

A number of studies have reported significant improvements in word retrieval in persons with aphasia who complete semantic tasks, particularly when they are associated with verbal production of target words; that is, semantic+phonologic training methods (e.g., Drew & Thompson, 1999; Pring, White-Thomson, Pound, Marshall, & Davis, 1990). Gestural treatments have also resulted in significant naming improvements in some persons with aphasia, particularly when gestures are paired with phonological production of words (Pashek, 1997; Raymer & Thompson, 1991). Rose and Douglas, (2001) and Rose, Douglas and Matyas, (2002) noted that gestural and verbal treatment on persons with phonologically based word retrieval impairment have shown more improvement compared to those with semantically

based word retrieval failure. Druks (2002) noted that gesture form of treatment is more effective for verb retrieval since there are close links between verb retrieval network and action.

According to a review by Rose, Raymer, Lanyon and Attard (2013) verbal and gesture combination improves treatment of verbs and nouns naming. Carry over effects for treatment to measures of connected speech have also been observed by certain researchers. However, they also stated that it cannot be generalised for untreated words and they have opined that it is difficult to judge the independent contribution of gesture towards the outcome of treatment.

Gesture therapy can be provided as a compensatory modality also. Rose et.al., (2013) in their review study have mentioned that several studies have shown improvements in performing gestures by due to gesture therapy and a few studies have also explored that compensatory gesture therapy makes a gain in communication abilities. In persons with Aphasia, Rodriguez, Raymer and Rothi (2006) have observed that an increased gesture communication provides an alternate mode of communication for people who could not communicate otherwise.

Hence, it can be concluded that gestures are extensively used by every human being. It starts to develop in early infancy. A lot of studies have commented that gestures are preserved in many individual with communication disorders. With respect to management, it is seen that the performance of the individual is better when the therapy approach includes gestural mode along with the speech.

CHAPTER III

Method

The aim of the study was to develop gesture corpus for the set of verbs and validate the same.

The study was conducted in the following phases:

1. Phase 1: Stimulus generation- In this phase, the process and procedure for developing the gesture videos have been discussed.
2. Phase 2: Rating- This phase has the procedure for obtaining the appropriateness rating from raters.
3. Phase 3: Validation- In the final phase, the obtained corpus was validated by a group of participants.

For all the phases, the following equipment/tools were used:

(a) Laptop of 15.6 inches with 1366 x 768 resolution

(b) HD video recorder (Nikon D3300)

(c) Appropriateness rating scale for gestures

Ethical guidelines:

Ethical guidelines framed by the AIISH Ethical Committee were adhered to while conducting the present study.

Phase 1: Stimulus generation

Sources for generating the stimuli.

i. Action Naming Therapy (ANT) (Shyamala & Girish, 2015)

ii. Manual for Adult Aphasia Therapy in Kannada (MAAT) for selection of verbs (Goswami, Shanbal, Samasthitha & Navitha, 2010)

iii. Words adapted from a study by Prarthana and Rao (2015)

Set of 141 verbs from standardized linguistic material [Action Naming Therapy (ANT) which is a test for verb retrieval, Manual for Adult Aphasia Therapy (MAAT) which is a treatment tool for aphasia and word list developed by Prarthana & Rao were collected which were presented in orthographic form to the actors.

Actors for developing the gesture corpus. Four individuals from different backgrounds [Speech Language Pathologist (SLP),, Audiologist, SLP with dance background or training in dance, audiologist with acting background or training in theatre arts.] served as actors who enacted the gestures for the set of verbs with written informed consent. These individuals were chosen here to enact the gestures in a comprehensive and useful manner. The SLP and audiologist are the individuals who frequently interact with persons with communication disorders who may or may not resort to a gestural mode of communication. A trained dancer would provide an extensive and enriched gesture for better clarity in the stimulus corpus. A trained actor would perform the gesture in simple manner with natural expressions.

Table 1:

Demographic data of the actors selected for the study

Sl. No.	Actors	Age and Gender	Profession	Form of art pursued	Years of experience in the art form
1	Actor 1	23 years/ Female	SLP	Classical dance	17 years
2	Actor 2	28 years/ Female	Audiologist	Classical Dance	20 years
3	Actor 3	32 years/ Male	Audiologist	Dramatics	15 years
4	Actor 4	32 years/ Female	SLP	Classical Dance	15 years

Procedure for developing gesture videos. The actors were invited and were instructed to enact a spontaneous and comprehensive gesture as the stimuli were presented. The video recording of the gesture videos took place in an acoustically treated room where the ambient noise level was within the permissible limits as specified by ANSI S3.1-1999 (R2008). This was carried out to ensure minimal distraction. A triangular gesture space of 112.5m^2 was provided for the actors, which was marked using a border. A cross mark was provided, on which the actors were asked to stand after performing the gesture or while carrying out gestures which did not require movement within the gesture space. The stimuli were presented in orthographic form (72 point size, black color, and Times New Roman font) on a

Laptop of 15.6 inches with 1366 x 768 resolution which was kept at a distance of 3 meters from the actor. The duration of the stimulus presentation and duration for enacting gesture and inter-stimulus duration were 3sec, 10sec, and 3 sec respectively. This was selected based on the convenience of the enactors who participated in the pilot study wherein two enactors gestured ten verbs. There wasn't any form of interaction between the four actors. The performance was video recorded using an HD video recorder (Nikon D3300) which was kept at a distance of 4 meters from the gesture space. The recorded gestures were formatted and edited using Windows Movie Maker (Version 2012, Build 16.4.3508.0205), an open source video editing software by Microsoft.

Phase 2: Appropriateness Rating

Participants. Eighteen individuals, from the southern zone of India, across different domains served as raters post a written informed consent from them. This included three Speech Language Pathologists, three audiologists, three special educators, three sign language users/trainers/ interpreters, three caregivers of persons with a communication disorder and three individuals who do not have any experience with persons with communication disorders (commoners). The three caregivers of persons with a communication disorder were each parents of persons with Hearing Impairment, Cerebral Palsy and Aphasia and all of them have been attending speech language therapy at AIISH, Mysuru. This wide range of participants was selected here so as to give a holistic rating of the gesture set derived, from a varied perspective.

Procedure for obtaining appropriateness rating. The gesture set derived from all the four actors of phase 1 were randomized and presented to the raters. A rating scale consisting of 3 points (poor-0, fair-1, good-2) for rating the gestures

across three domains such as familiarity, simplicity, and relevancy adapted from Feedback Questionnaire for Aphasia Treatment Manual developed by Goswami, Shanbal, Samasthitha and Navitha (2011) was used. The individual rater was invited and briefed about the study, and the rating was carried out in a quiet environment. The raters were shown a specific gesture video for a maximum of two times and were given a maximum time of two minutes for each gesture video to be rated. The gestures receiving fair and good rating and with good inter-rater reliability were selected and underwent the third phase of the study, i.e., validation.

Phase 3: Validation

Participants. A total of ten native Kannada speaking neurotypical adults above 18 years were selected for this phase of the study. The participants were screened for any speech, language or sensory issues.

Procedure for validation. The gestures set derived after phase 2 were presented to the neurotypical adults for a maximum of 2 times and were instructed to name them. The participants were provided with paper and pen to enter their responses against the presented serial number of the gesture video. The responses were validated using appropriate statistical analysis.

The final corpus of the study includes only those gestures which have good consensus among the validators and with the stimuli used in phase 1.

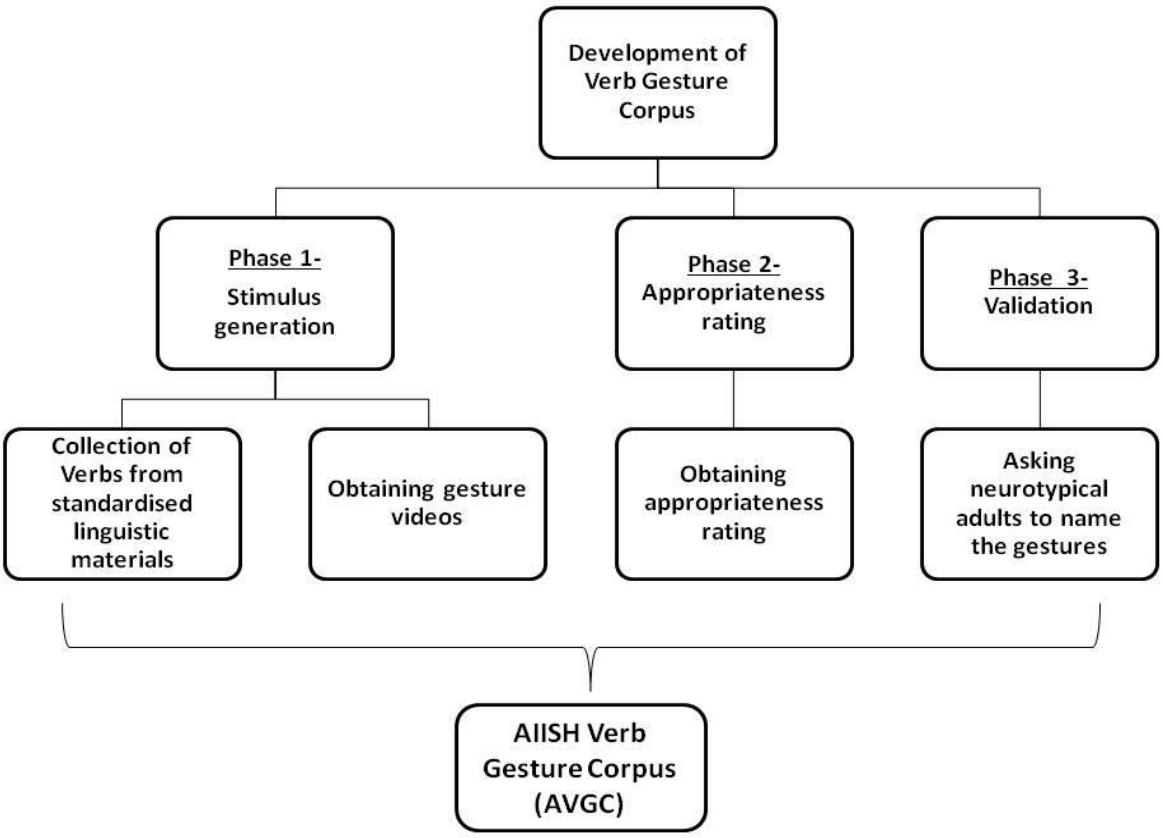

Figure 1: Development of AIISH Verb Gesture Corpus.

Finally the "AIISH Verb Gesture Corpus (AVGC)" has been presented in digital form with the following materials:

i. User manual

ii. Corpus of verbs

iii. Gesture videos

CHAPTER IV

Results and Discussion

The primary aim of the study was to develop a gesture corpus for commonly used verbs. The procedure consisted of recording videos of gestures performed by four different actors which were later rated by eighteen raters from six different backgrounds. The videos selected post rating was given for validation for 10 neuro-typical individuals. The procedure was carried out in three phases; phase1 was recording of gesture videos, phase 2 was rating of the videos and phase 3 was validation.

The results of the study are discussed in 3 phases.

Phase1: Recording of gesture videos

Phase 2: Rating of gesture videos

Phase 3: Validation of the selected gesture videos

In the first phase, 141 verbs were selected from various sources [Action Naming Therapy (ANT) (Shyamala & Girish, 2015), Manual for Adult Aphasia Therapy in Kannada (MAAT) for selection of verbs (Goswami, Shanbal, Samasthitha & Navitha, 2010) and Words adapted from a study by Prarthana and Rao (2015)] for four different actors to enact; therefore there were a total of 564 (141 X 4) gesture videos. Two typical gestures have been shown in Figure 2 and Figure 3. Out of 141 verbs, 15 of them were collected from MAAT, 57 of them were collected from ANT and 69 of them were collected from words adapted from Prarthana and Rao (2015).

Figure 2: Gesture for saluting.

Figure 3: Gesture for eating.

In phase 2, the recorded videos were presented on a laptop, using VLC media player. The raters were asked to rate it on three parameters; familiarity, simplicity and relevance of the performed gesture using a three point (0, 1, 2) rating scale. A mode of the three parameters was taken for each word, for each rating. The mode would

represent the overall rating of the gesture video. In cases where operation of mode was not applicable, like in a condition where the rating for the three parameters were 0, 1 and 2; median was taken to represent the overall rating of the three parameters.

The obtained overall rating was again subjected to mode, upon which the overall rating of all the 18 raters (three Speech Language Pathologists, three audiologists, three special educators, three sign language users/trainers/ interpreters, three caregivers of persons with a communication disorder and three individuals who do not have any experience with persons with communication disorders) was obtained.

The gesture videos with the overall rating as "2" were selected for the next phase; validation, irrespective of the actor who enacted the gesture video; i.e. if more than one actor received a rating of "2" on the same verb, all the gesture videos that received rating of "2" would be retained. 70.93% of gesture videos performed by actor 1 received the rating as "2" and were selected for the next phase. Similarly, 90.08 %, 80.86% and 78.02% of gesture videos performed by actor 2, actor 3 and actor 4 respectively were selected for the validation. During the process of selection 19.68% of gesture videos were rejected. The rejected videos were either not familiar, difficult to comprehend, or not culturally relevant. Nine videos were rejected as the depiction of the words was incorrect; i.e. the words were gestured for nouns instead of verbs. For example, words like cool and heat were gestured for their noun form instead of the verb. In another example, the word tear was gestured for tears (noun form) rather than tearing the paper.

Table 2:

Percentage of rejected gesture videos with respect to each actor

Actors	Percentage of rejected videos
Actor 1	29.07 %
Actor 2	9.92 %
Actor 3	19.14 %
Actor 4	21.98 %

On observing professional categories wise, it was observed that Speech language Pathologists rejected 182 gesture videos which accounts for 32.26% of the list of verbs provided for enacting gestures. Similarly, Audiologists rejected 84 videos (14.89%), Special Educators rejected 67 gesture videos (11.87%), Sign Language Users/Interpreters rejected 145 gesture videos (25.70%), Caregivers rejected 191 gesture videos (33.86%) and commoners rejected 111 gesture videos (19.68%) (Figure.4).

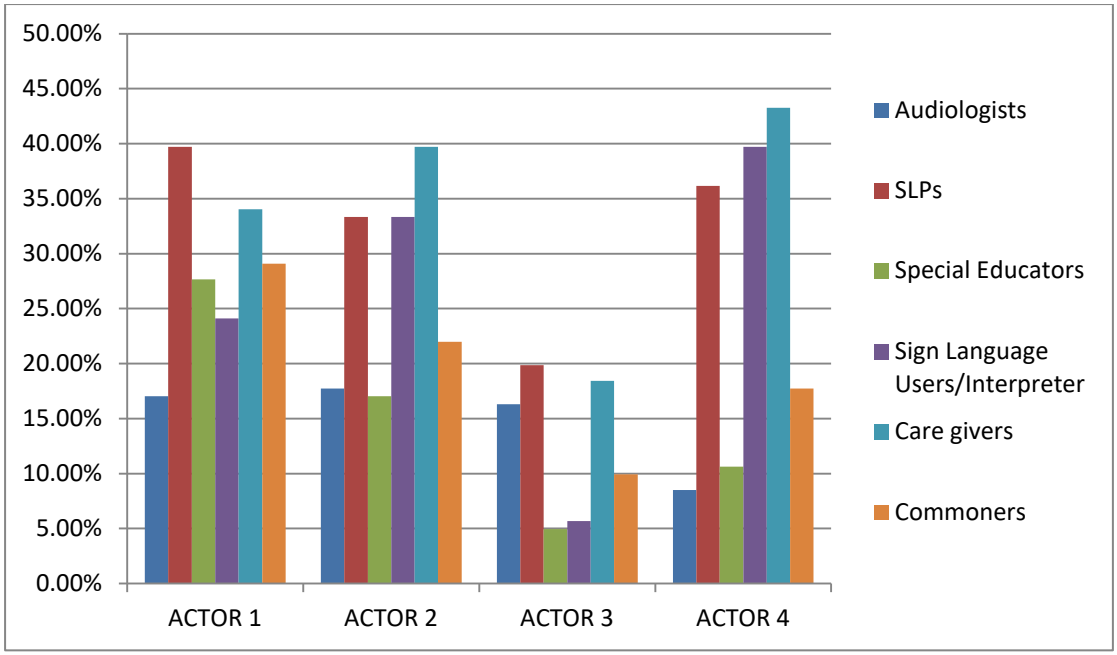

Figure 4: Percentage of gesture videos rejected (professional category specific).

It was observed that there was consensus between the different professionals. Across the four actors it was observed that the SLPs and the care givers shared higher consensus, and the percentage of the rejected gesture videos were also higher. This might be due to the fact that SLPs tend to concentrate more on speech aspects or co-speech gestures rather than gestures and in turn communication per say. Therefore, it is essential for SLPs to note the importance of communication over speech, where as in present scenario the later is given preference by the SLPs and the caregivers. It was also observed that the Sign Language User also had higher percentage of rejected gesture videos. The sign language and gestures might be similar in many ways but gestures lack the structured and rule based language structure which is present in sign language. Also, the sign language does not involve full body movements, unlike gestures where the movement of the body is not restricted. Therefore, it might have been difficult for the Sign Language Users to comprehend the gestures. Audiologists and Special Educators shared a consensus with respect to the percentage of the

rejected videos. They had the least percentage of rejection of gesture videos, i.e. they were familiar with and were able to comprehend most of the gesture videos. It is well known that the Special Educators not only concentrate on the speech aspect, but utilize and look for non speech aspects like facial expressions, signs, visual representations using pictures or orthographic forms. Therefore, the gestures might have been easily understood and accepted by them.

The obtained gesture videos were analyzed in terms of their type based on McNeil's classification i.e. iconic, metaphoric, deictic and beat gestures. Gestures were also analyzed based on transitive and intransitive gestures. Ratings for the gestures were also observed with respect to frequency and imageability of the verbs.

With respect to frequency of occurrence of verbs, it was observed that more frequent words were highly rated compared to not very frequently occurring words. It was also observed that the obtained ratings for gesture videos were higher for the videos of highly imagery verbs compared to that of non imagery verbs. Rogers and Oborne (1987) conducted a study where the subjects were asked to draw a set of verbs. They supported this finding by opining that it was easier to produce and understand highly imagery verbs.

Most of the videos enacted were iconic in nature i.e. the gestures enacted were a description of an action or an event. This is valid since verbs are nothing but description of action, state or occurance. A few examples from the study are writing, jogging, watering, buying, selling; were the actions for these verbs were enacted. Certain gestures could be referred to as emblematic gestures as well. These words were unconsciously perceived but consciously used, and could be used as a substitute for a spoken word. For example, the verbs eating, sleeping and writing were represented in same manner by all the actors.

With respect to transitive and in transitive verbs, Mozaz, Rothi, Anderson and Crucian (2002) who attempted to check for postural knowledge of intransitive and transitive gestures opined that individuals performed better for intransitive than transitive gestures; with respect to both comprehension and expression. Carmo and Rumiati (2009) also suggested that it is more difficult to imitate and comprehend transitive gestures than intransitive gestures. However in the present study it was seen that gestures for the transitive verbs received better ratings. One could speculate that the transitive verbs could have been easier to enact due to its concreteness and its context dependency. Further, there would have been lesser discrepancy between the raters for the gestures of transitive verbs. This finding is supported by a study by Jonkers and Bastiaanse (1996) where they reported that transitive verbs are easier to retrieve than intransitive verbs.

In the present study, it was also observed that for certain verbs, the actors enacted more than one action per verb. For example, for the verb praying, culturally different gestures were enacted. In another example, the verb carrying was enacted by both carrying a baby and carrying a bag (Figure 5 & Figure 6). Also, the gesture performed by the actors for certain verbs like rowing and boating, cooking and frying, stitching and knitting, running and jogging (difference was noted only with respect to the speed) (Figure 7 & Figure 8), were similar to each other. If these gesture videos were presented in isolation, it was difficult for the verb to be identified correctly and would be named interchangeably. When played one after another, the meaning of each of the verb gesture was better projected.

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Figure 5: Gesture for carrying (carrying a baby).

Figure 6: Gesture for carrying (carrying a bag).

Figure 7: Gesture for jogging.

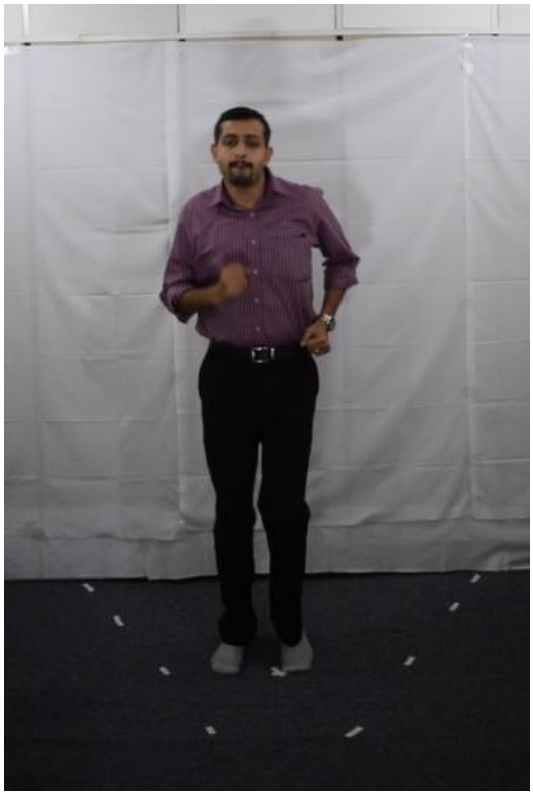

Figure 8: Gesture for running.

Actors could not find appropriate gesture for a few verbs. Verbs like do, start and save, even though being frequently used verbs, were not assigned a particular gesture by the actors. For certain verbs like ask, the gesture was broken into two parts, what and say which were combined to depict the verb (Figure 9). The probable reason for not being able to depict the verb directly could be poor iconicity of the mentioned verbs.

Figure 9: Gestures for ask (what + say).

In phase 3, the selected videos were then given to 10 neuro-typical individuals who named the gesture videos. The age of the individuals ranged from 23 to 54 years. The gesture videos that were named appropriately by at least 80% of the validators were considered for the preparation of the corpus and the ones that were named incorrectly or inappropriately were discarded. Synonyms were considered as appropriate naming. It was noticed that gestures that were more frequently used and

more representable were correctly named by the validators. 60 % of gesture videos (60 gesture videos) selected for validation which was performed by actor 1 was named appropriately and were selected for the next phase (Figure 10). Similarly, 63.71 % (79 gesture videos), 68.51 % (74 gesture videos) and 61.68 % (66 gesture videos) of gesture videos selected for validation which was performed by actor 2, actor 3 and actor 4 respectively were selected as a part of gesture corpus (Figure 11, Figure 12 & Figure 13). During the process of selection, considering all four actors, in total 279 out of 439 gesture videos which pertained to 63.55% of gesture videos were selected for being a part of the gesture corpus (Figure 14). The frequency distribution of percentage of scores for gestures performed by each actor shared a similar trend. The gesture videos were not considered for the corpus development if the gesture videos were named incorrectly or if they were not named at all by the validators. Out of 439 gesture videos that were provided for validation, 40 gesture videos were not named by the Validator 1. Similarly, 17, 32, 14, 29, 20, 35, 73, 89 and 56 gesture videos were not named by the Validator 2, Validator 3, Validator 4, Validator 5, Validator 6, Validator 7, Validator 8, Validator 9 and Validator 10 respectively. In total, 279 gesture videos were selected at the end of the validation process.

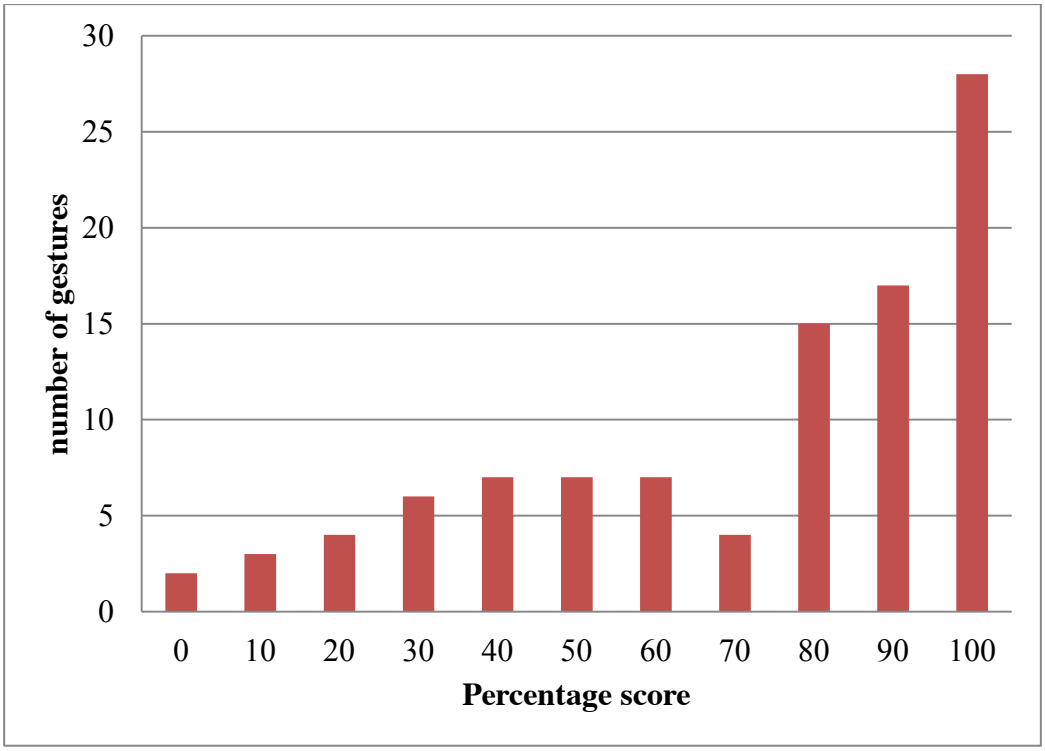

Figure 10: Frequency distribution of percentage of scores for gestures performed by Actor 1.

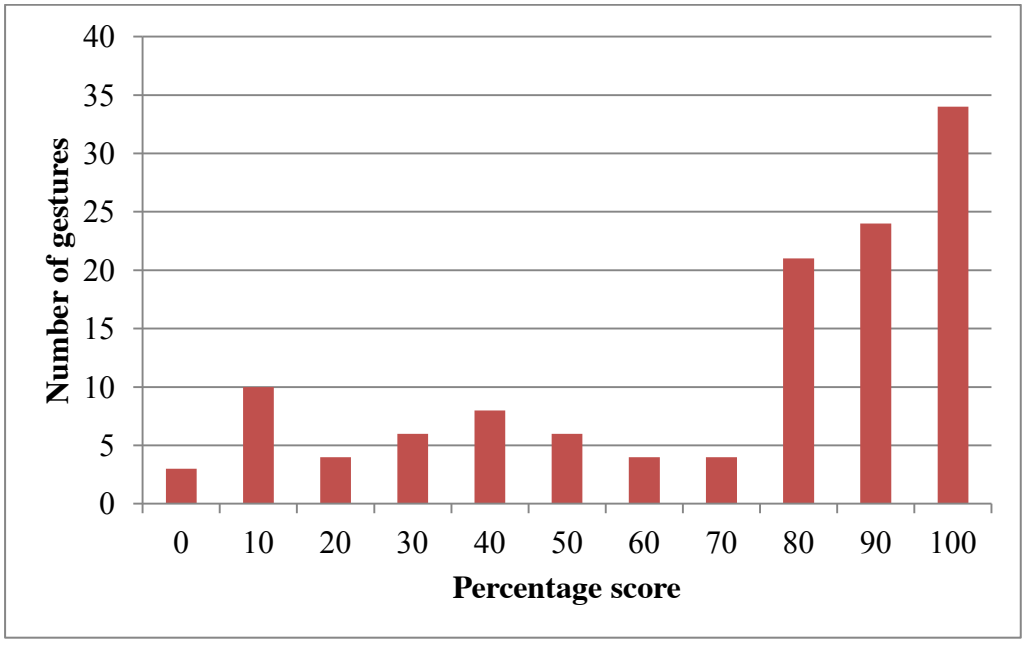

Figure 11: Frequency distribution of percentage of scores for gestures performed by Actor 2.

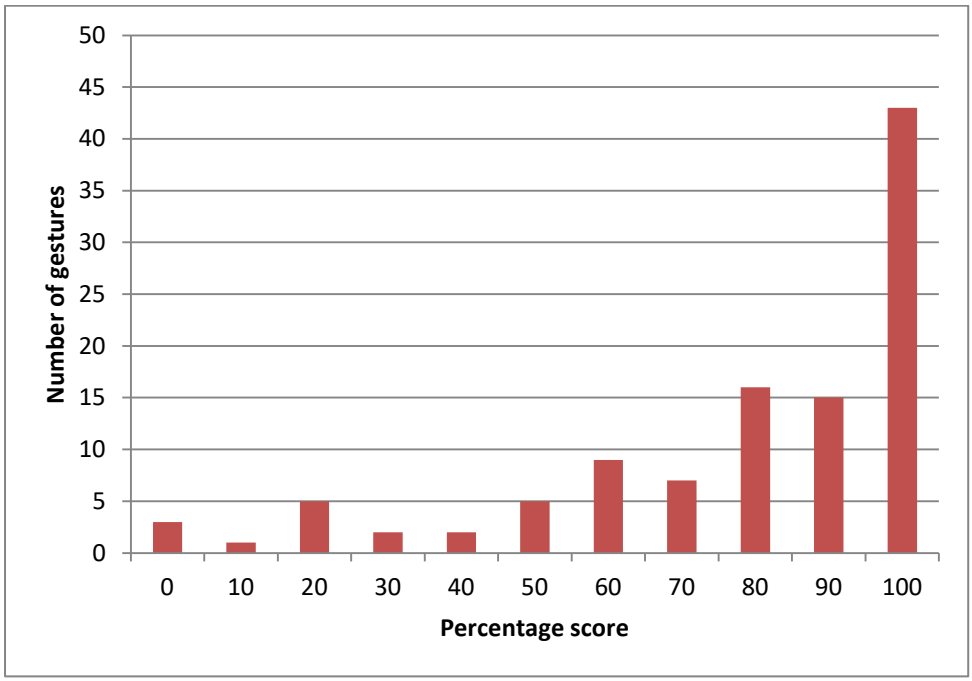

Figure 12: Frequency distribution of percentage of scores for gestures performed by Actor 3.

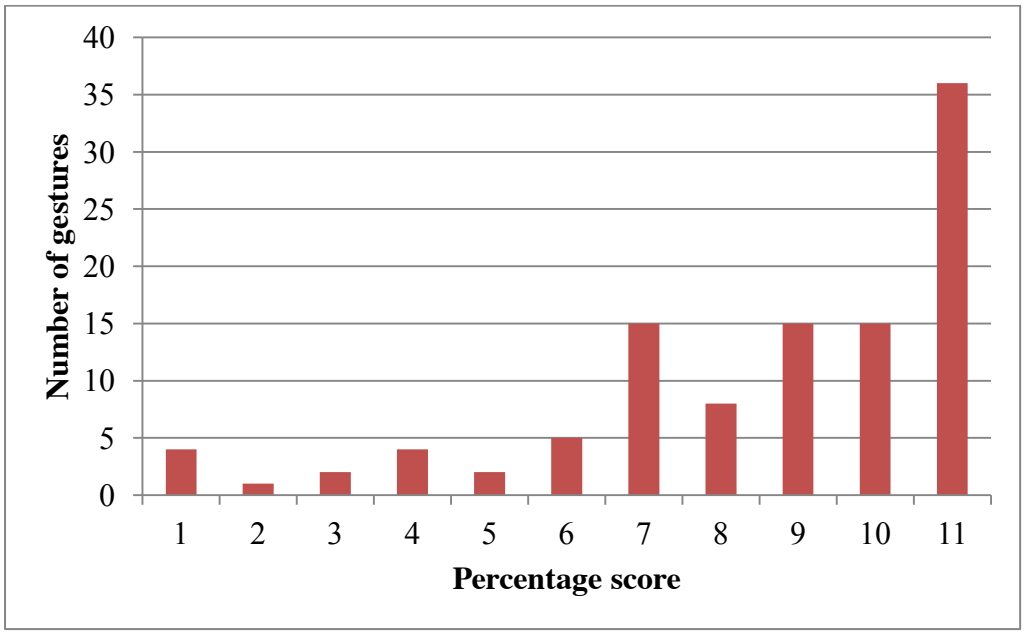

Figure 13: Frequency distribution of percentage of scores for gestures performed by Actor 4.

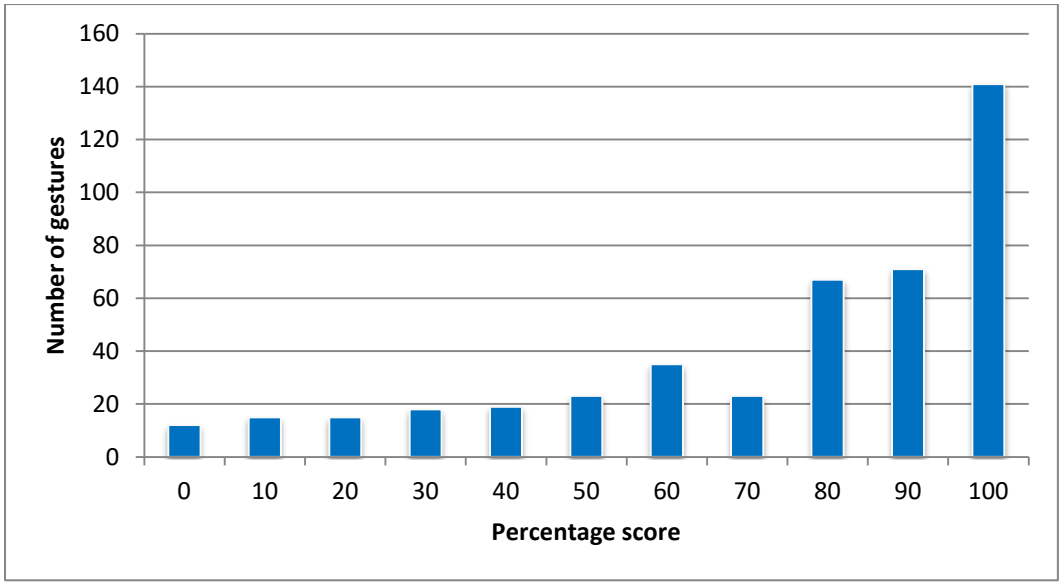

Figure 14: Frequency distribution of percentage of scores for gestures.

With respected to the selected gestures post validation, 21.51% of the gesture videos were from the Actor 1, 28.31% of the gesture videos were from the Actor 2, 26.52% of the gesture videos were from the Actor 3 and 23.66% of the gesture videos were from the Actor 4 (Figure 15). All the actors performed more or less similarly and received similar ratings and scores.

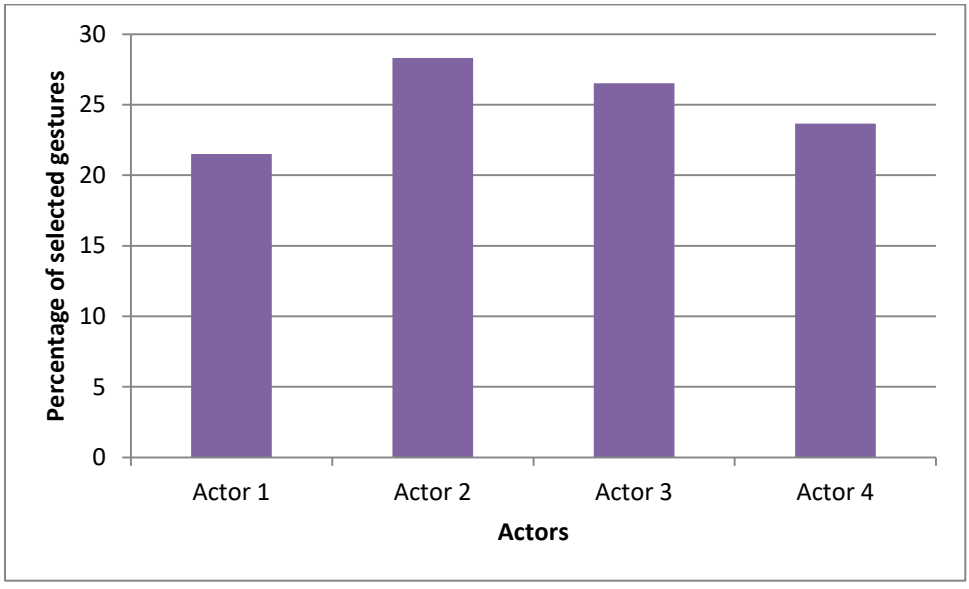

Figure 15: Percentage of gesture videos selected post validation with respect to each actor.

The raters/validators also commented that the gesture videos of Actor 4 were very brief and crisp with lesser change in expressions and had very limited movements involved. The validators observed that the gesture videos by the Actor 2 were very elaborate. The elaborate nature of gesture produced by the actor might be correlated to the fact that this particular actor also pursues dancing and is a trained and proficient dancer since 20 years. The years of experience might have contributed to the better and elaborate performance of the gestures. The validators also felt that the gesture videos by the Actor 3 were very natural and full of expressions. It is important to recollect that Actor 3 is an Audiologist who pursues acting/ dramatics since 15 years. The amount of exposure to acting might have benefitted the actor in performing natural yet very expressive gestures.

Post validation, since a number of verbs were given same ratings and validation for gestures performed by all the four actors, the final verbs for gesture corpus in such situation was selected by selecting the gesture video with highest word agreement percentage a gesture corpus. If the percentage of word agreement was also similar, then the videos were selected on a random basis. In the end, a gesture corpus was prepared which consisted of 106 gesture videos for the verbs. A manual was prepared for the better understanding of the use of the gesture corpus, which has been enclosed in Appendix I. The manual consists of an overview of the material, instructions on how to use the material and a score sheet (Appendix II).

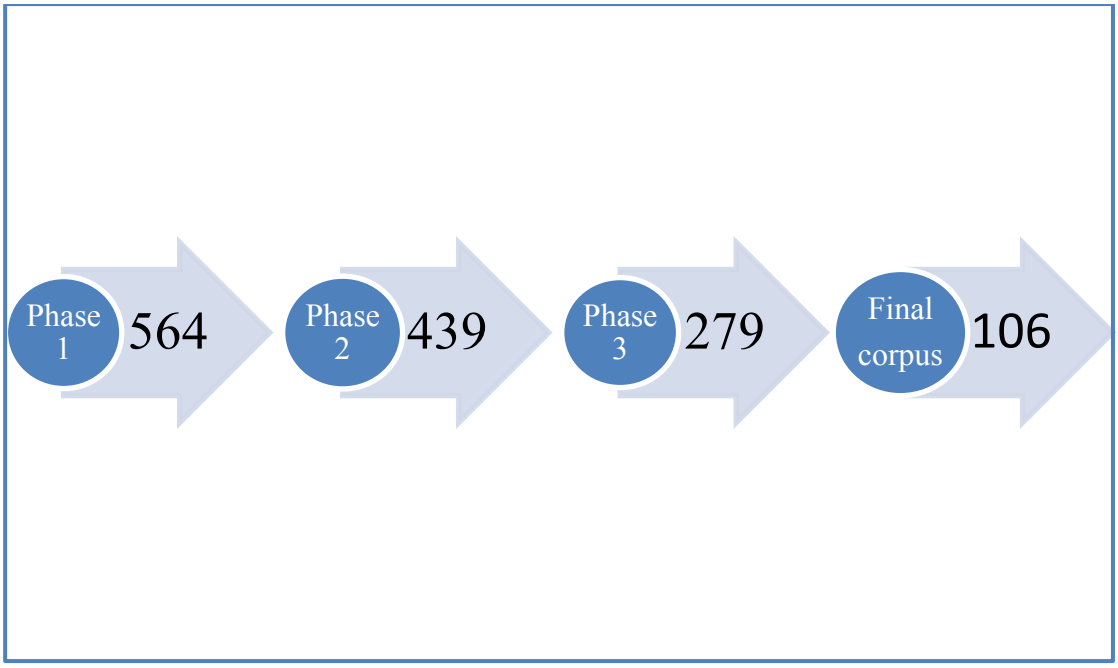

Figure 16: Number of verb gestures at each phase.

CHAPTER V

Summary and conclusion

The aim of the present study was to develop gesture corpus for the set of verbs, validate the stimulus and to classify the gestures across types for the set of verbs. It is a very well known fact that gestures are important in communication sciences across development, learning, assessment, and therapeutics. Verbs form the major part of the verbal language which describes an action, state, or occurrence. It is the major part of the sentence, i.e. the predicate, and helps in understanding the meaning of the sentence and is extensively used in everyday conversation. Due to a dearth of literature on the use of the gestural form for the same, the need for the development of gesture corpus was felt. The study was carried out in three phases. Phase 1 consisted of recording of gesture videos for a set of 141 verbs collected from various sources. The gestures were performed by 4 actors who were Speech Language Pathologists and Audiologists who were also trained dancers or drama artists. In Phase 2, the recorded gesture videos were given to 18 raters for rating the videos with respect to three different parameters (familiarity, simplicity and relevance of the gesture videos presented) using a 3-point rating scale. The raters were from different professional background; Speech Language Pathologists, Audiologists, Special Educators, Sign Language users/Interpreter, Care givers of persons with communication disorder and commoners. The mode was taken to represent a score for each gesture video and a mode across different raters was applied to select or reject the videos. The gesture videos obtained after phase 1 were also analyzed based on types of gestures and it was observed that verbs were best represented using iconic gesture. At the end of phase 2, 439 gestures were selected. The selected gesture

videos were subjected to validation, where 10 neurotypical individual were asked to name the gesture videos. The gesture videos that received 80% or more word agreement on naming were selected to be a part of the gesture corpus that was developed. At the end of phase 3, 279 gesture videos were selected. The gestures for the corpus were selected on a random basis if all the four actors' gesture videos received the same rating and validation for a particular verb. In the end, a gesture corpus consisting of 106 gesture videos was prepared. Gesture corpus that is developed as a result of the study can be used as a part of a protocol for assessment in case of difficult to test population. Similar to picture naming therapy, gesture naming therapy can be developed using the gesture corpus. It will serve as a base for designing of Augmentative and Alternative Communication (AAC) symbols which could again be used for assessment and management of individuals with communication disorders. It can aid in communication for individuals who acquire a loss of language abilities, and who are not familiar with sign language; especially in hospital settings during their initial days of treatment. The gesture corpus can also serve as a useful material for further experimental research. After the process of validation, manual was prepared to accommodate the gesture corpus, an overview about how to use the corpus and a score sheet for assessment and management purposes.

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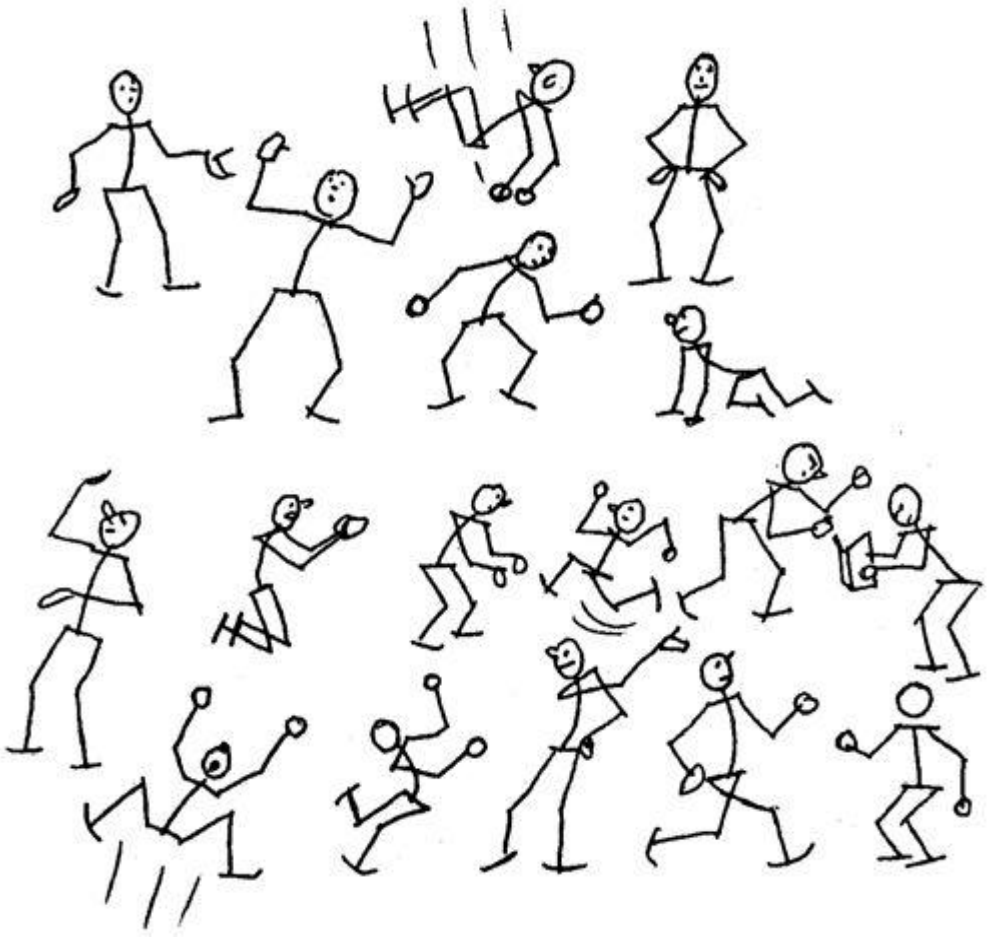
APPENDIX A

Manual

Manual for AIISH Verb Gesture Corpus

(AVGC)



Communication

Communication is the process of sharing information between two or more persons and is broadly divided into verbal and nonverbal communication. When the message is sent to the listener through the spoken language, it is referred to as Verbal communication. When the communication does not occur through the spoken language, then it is referred to as non-verbal communication. Haptic communication, gestures, body language, facial expressions and eye contact are a few examples of nonverbal communication.

Gesture

A gesture is a form of non-verbal communication which utilizes visible bodily actions for communication. It can be used either in place of or in conjunction with, speech. Gestures include movement of the hands, face, legs or other parts of the body. Gestures not only facilitate communication of a variety of feelings and thoughts but also help in providing the same meaning as that of spoken language content and also providing additional information.

Why AVGC?

Since gesture is one of the important aspects of communication, it is very much necessary to have a corpus of gesture which can be used for various purposes. It can be used as a part of a protocol for assessment in case of difficult to test population. Similar to picture naming therapy, gesture naming therapy can be developed using the gesture corpus. It will serve as a base for designing of Augmentative and Alternative Communication (AAC) symbols which could again be used for assessment and management of individuals with communication disorders. It

can aid in communication for individuals who acquire a loss of language abilities, and who are not familiar with sign language; especially in hospital settings during their initial days of treatment.

Why verbs?

Verbs form the major part of the spoken language which describes an action, state, or occurrence. It is the major part of the sentence and helps in understanding the meaning of the sentence and is extensively used in everyday conversation. It is also evident that verbs are the major part of action language (signs and gestures) which is represented holistically. However, there are limited validated verb gestures available for professionals to be used for clinical and research purposes.

Who can use AVGC?

This gesture corpus can be used for a variety of clinical population such as persons with Aphasia, Dementia, Cerebral Palsy, Hearing Impairment and other degenerative and nondegenerative diseases who are finding it difficult to use spoken language form.

About AVGC development:

The development of AIISH Verb Gesture Corpus was carried out in three phases. In the first phase, gesture videos were recorded for a set of 141 verbs collected from various sources. The gestures were performed by 4 actors who were Speech-Language Pathologists (2 in number) and Audiologists (2 in number) who were trained dancers or drama artists. In the second phase, 18 raters were asked to rate the obtained gesture videos the videos with respect to three different parameters (familiarity, simplicity, and relevance of the gesture videos presented) using a 3-point

rating scale. The raters were from different professional background; Speech-Language Pathologists, Audiologists, Special Educators, Sign Language users/Interpreter, Caregivers of persons with communication disorder and commoners. The gesture videos which obtained the highest rating by all the raters were selected for the next phase. At the end of the second phase, 439 gestures were selected. In the third phase, the selected gesture videos were subjected to validation, where 10 neurotypical individuals were asked to name the gesture videos. The gesture videos that received 80% or more word agreement on naming were selected to be a part of the gesture corpus that was developed. At the end of phase 3, 279 gesture videos were selected.

Materials Required:

1. Laptop or any screen for projection of the gesture videos
2. Software for playing the gesture videos (VLC media player, Windows media player, or others)
3. Score sheet

Time of administration: Approximately one hour.

It depends upon the task for which the AVGC is used and the patient's reaction time for each gesture.

A few tasks that can be carried out using AVGC:

1. Recognition/naming of gesture
2. Imitation of gesture videos
3. Choosing the correct gesture video from the provided choice for a given verb gesture
4. Training for comprehension of gesture videos

Instructions (for recognition task):

1. Make the person to be seated in a comfortable position and a comfortable distance from the laptop/screen.
2. Instruct the person saying "I will be playing a set of videos consisting of verbs, one after another. Please indicate what the video is representing."
3. Score the responses accordingly in the score sheet provided.

The total score obtained can serve as a baseline for planning intervention. The mode of response might indicate which mode is going to be more effective during management.

Scoring

A mention of the mode of response must be made. A score of "1" must be awarded for the correct response. Synonyms of the verb are also considered as a correct response. A score of "0" must be provided for every incorrect response or no response. It is to be noted that the responses can be in any mode. The mode of response should be of a free choice depending upon the person's condition.

APPENDIX B

Score sheet

SL. NO.	Verbs	Mode of Response				Score	
		Verbal	Orthographic	Imitation	Any other (specify)	Correct (1)	Incorrect (0)
1	Eating						
2	Walking						
3	Cutting						
4	Calling						
5	Blowing						
6	Dancing						
7	Shaking						
8	Shouting						
9	Tasting						
10	Stitching						
11	Finishing						
12	Mopping						
13	Swallowing						
14	Sweeping						
15	Searching						
16	Brushing						
17	Kneeling						
18	Burning						

SL. NO.	Verbs	Mode of Response				Score	
		Verbal	Correct (1)	Incorrect (0)	Any other (specify)	Correct (1)	Incorrect (0)
19	Throwing						
20	Diving						
21	Pointing						
22	Seeing						
23	Falling						
24	Beating						
25	Saluting						
26	Joining						
27	Sitting						
28	Pouring						
29	Sleeping						
30	Rolling						
31	Painting						
32	Spitting						
33	Spinning						
34	Washing						
35	Peeling						
36	Hiccuping						
37	Crying						
38	Paining						

SL. No.	Verbs	Mode of Response				Score	
		Verbal	Orthographic	Imitation	Any other (specify)	Correct (1)	Incorrect (0)
39	Riding						
40	Waking						
41	Increasing						
42	Pulling						
43	Climbing						
44	Burping						
45	Lifting						
46	Drowning						
47	Cooking						
48	Counting						
49	Buying						
50	Picking						
51	Smelling						
52	Showing						
53	Whispering						
54	Flying						
55	Winking						
56	Bathing						
57	Drinking						
58	Praying						

SL. No.	Verbs	Mode of Response				Score	
		Verbal	Orthographic	Imitation	Any other (specify)	Correct (1)	Incorrect (0)
59	Breaking						
60	Sneezing						
61	Smoking						
62	Running						
63	Fighting						
64	Laughing						
65	Biting						
66	Yawning						
67	Coughing						
68	Slapping						
69	Swinging						
70	Slipping						
71	Writing						
72	Watering						
73	Ironing						
74	Reading						
75	Weighing						
76	Grating						
77	Exploding						
78	Winning						

SL. NO.	Verbs	Mode of Response				Score	
		Verbal	Orthographic	Imitation	Any other (specify)	Correct (1)	Incorrect (0)
79	Touching						
80	Jogging						
81	Kissing						
82	Combing						
83	Jumping						
84	Killing						
85	Carrying						
86	Telling						
87	Playing						
88	Squeezing						
89	Selling						
90	Kicking						
91	Thinking						
92	Singing						
93	Fishing						
94	Barking						
95	Tearing						
96	Chewing						
97	Standing						
98	Exercising						

SL. NO.	Verbs	Mode of Response				Score	
		Verbal	Orthographic	Imitation	Any other (specify)	Correct (1)	Incorrect (0)
99	Gardening						
100	Swimming						
101	Hugging						
102	Proposing						
103	Punching						
104	Pushing						
105	Rowing						
106	Hitting						
	Total						