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Pre-Symbolic and Symbolic Communication Behaviors of Typically Developing Children (1.6 Years) in Dyadic Communication Context Using Adapted Communication Complexity Scale

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Abstract:-Communication complexity scale (CCS)Brady et al., 2012 [1]was developed to assess the communication of individuals with intellectual disabilities and developmental disabilities who are mostly presymbolic communicators in the context of examiner-child scripted interaction. In the present study, CCS was adapted to assess communication oftwo typically developing children of 1.6 years age in unscripted free-play interaction context with their mothers. The communication of both children were analyzed to find the types of presymbolic and symbolic communication behaviors that occurred as a single entity with the three orientation patterns namely single, dual and triadic orientation. Results revealed predominant use of intentional communication by both children. On analyses of the patterns of combination of pre-symbolic and symbolic communication behaviors with single, dual and triadic orientation, for child K most combinations occurred with dual orientation (5 combinations) followed by equal number of combinations (3 combinations each) in single and triadic orientation. In contrast, for child S most combinations occurred with triadic orientation (5 combinations) followed by dual orientation (3 combinations) and finally single orientation (2 combinations). Considering that the behavior complexes that occurred with dual and triadic orientation were categorized as intentional communication, both children were mostly intentional communicators. Thus the present study demonstrates successful adaptation of CCS for typically developing children who are mostly intentional communicators.

Key words: *Communication Complexity Scale (CCS), Conventional gestures, Deictic gestures, Presymbolic, Proto-words, Symbolic, Vocalization, Words*

I. INTRODUCTION

One of the most important and challenging tasks in the field of communication disorders is to aptly describe communication behaviors in infants and children.For precise and objective description of communication behaviors, several assessment tools and protocols have been developed. These protocols are primarily based on the development of communication in typically developing (TD) children.In the developmental continuum of TD children, initially presymbolic behaviors emerge and is followed by symbolic communication behaviors. Presymbolic communication behaviors predominantly include vocalization and deictic gestures.Vocalizations are present at birth and continue to develop change its form till the 7 months of age (Oller, 2000 [2]). Emergence ofword like sounds or proto-wordsand deictic gestures emerge by 9-12 months of age (Bates, Benigni, Bretherton, Camaioni, &Volterra, 1979 [3];Bates, Camaioni, &Volterra,1975 [4]; Bruner, 1975 [5]; Masur 1983 [6]), followed by representational or symbolic gestures by 12 - 15 months of age (Acredolo&Goodwyn, 1988 [7]; Iverson, Caprici, & Caselli,1994 [8]). Use of combination of symbolic gestures and speech utterances is seen at around 12 months of age (Acredolo& Goodwyn, 1988 [7]; Bates, Benigni, Bretherton, Camaioni, &Volterra, 1979 [3]). At the same age, children produce their first words to label objects (Nelson, 1974 [9]) or to regulate social interaction (Bloom, 1973 [10]). To express their intentions, 12-month-olds primarily use gestures and/or vocalizations, 18-month-olds use a combination of gestures, vocalizations, and words or word approximations, and 24-month-olds use primarily words or word combinations (Wetherby, Cain, Yonclas, & Walker, 1988 [11]). Thus in children, in any stage of development, the communication behaviors can be a single behavior or combination of various components to form a complex.

The most researched deictic gestures are 'reaching', 'showing', 'giving', and 'pointing'. Typically, by the age of 8 or 9 months, open-hand 'reaching' develops. This is followed by development of 'showing' and 'giving' between 9 and 13 months (Masur, 1983 [6]). Specifically, 'showing' emerges at 10.7 months and 'giving' at 12.1 months age (Carpenter, Nagell, &Tomasello, 1998 [12]). Pointing to close objects is reported to emerge between 9 and 10 months, while distal pointing emerges at 13–14 months (Masur, 1983 [6]; Zinober &

Martlew, 1985 [13]). Crais, Douglas and Campbell (2004) [14] reported an earlier mean age of emergence of the deictic gestures. Accordingly the mean age of emergence of open handed 'reaching' was reported as 7.42 months (range = 6–10 months), 'giving' as 9.33 months (range = 8–11 months), 'showing' as 9.55 months (range = 8–13 months), and 'pointing' as 10.64 months (range = 9–12 months).The earlier age of emergence in the latter study was reasoned as the use of naturalistic observation as the data collection setting in contrast to parental report in laboratory settings used in the former studies.

Eye gaze fixation on the target object and alternation of eye gaze between the target and communication partner are important components of communication. Infants engage in face-to-face interactions with their caregivers at birth (Bigelow, 2003 [15]). By six to nine months of age, infants become increasingly capable of sharing experience about objects and events by directing or following the visual gaze of social partners (Bigelow, 2003 [15]; Mundy &Jarrold, 2010 [16]; Reinhartsen, 2000 [17]). Around this age, there is an important shift from dyadic to triadic or referential communicative interactions (Mundy & Willoughby, 1998 [18]). The cognitive development of the child explainsthe developmentfrom eye gaze fixationon mother or object of interest to alternation of eye gaze between the mother or object of interest or vice versa. The development of eye gaze alternation leads to the shift from pre-intentional to intentional communication (Beuker, Rommelse, Donders, &Buitelaar, 2013 [19]; Mundy & Newell, 2007 [20]; Mundy, Sigman, &Kasari, 1990 [21]).

Thus, different components of presymbolic communication develops simultaneously in a parallel fashion and so are the components of symbolic communication. At a given point in time, the child may use one or a combination of components of presymbolic communication behaviors (each component in a different stage of development) and/or symbolic communication behaviors as a complex behavior. This tendency to use combination of communication behaviors is explained by Local homology model. Local homology model tries to explain the relationship between the language and non-linguistic cognition. Accordingly, different aspects of language and gesture are likely to be associated only at specific points in time, when each draws on the same underlying processes or processing mechanisms(Thal & Tobias, 1994 [22]). It also proposes that different aspects of language may be dissociated in the early stages of development because they rely on different processing mechanisms (Bates, Benigni, Bretherton, Camaioni, &Volterra, 1979 [3]; Bates, Bretherton, Shore, &McNew, 1983 [23]). As per the model between 18-20 months there is a growth in vocabulary size and its resultant word combinations, growth in multiword utterances and this growth correlates with the multi-scheme gestural combinations (Brownell, 1988 [24]; Fenson& Ramsay, 1981[25]; McCune-Nicolich, 1981[26]; McCune-Nicolich&Bruskin, 1982 [27]; Shore, 1986 [28]).

For the purpose of precise and objective description of communication behaviors, parental interview protocols such as McArthur Bates Communication Developmental Inventory (CDI) words and gestures form (Fenson, Dale, Reznick, Bates&Hartung, 1993 [29]); Communication and Symbolic Behavior Scales (CSBS) Developmental profile (Wetherby &Prizant, 2002 [30]); Checklists for preschool children with communication disorders (0-6 years) (Swapna, Jayaram, Prema, &Geetha, 2010 [31]); Communication Matrix (Rowland, 1990, 1996, 2004 [32]; Rowland & Fried-Oken, 2010 [33]) have been developed. Although the information obtained through parental reports is extensive, there are several concerns such as challenge in eliciting information from parents on context and components of presymbolic communication that occur as a complex; possibility of parents to over-attribute intentionality to behaviors they report as a result of their familiarity (Petrovich-Bartell, Cowan, & Morse, 1982 [34]). In light of eliminating these concerns, several direct assessment procedures for evaluating the behavioral samples were proposed. These include the behavior sample section of the Communication and Symbolic Behavior Scale (CSBS) by Wetherby and Prizant (1993) [30], Early Social Communication Scales (ESCS) by Mundy et al. (2003) [34], Communication matrix (Rowland, 1990, 1996, 2004 [32]; Rowland & Fried-Oken, 2010 [33]), Communication complexity scale (CCS) (Wetherby &Prizant, 1993 [30]) and so on.

The behavioral sample section of Communication and Symbolic Behavior Scale (CSBS) Wetherby and Prizant (1993) [30]uses scripted play tasksto evaluate the use of eye gaze, gestures, sounds and words for communication in addition to child's use of objects and understanding of words. Early Social Communication Scales (ESCS) by Mundy et al.(2003) [35] also uses highly structured observation context and the elicited behaviors are classified into functions. The documentation of communication in infants and children using CSBS and ESCS aid in categorizing the communication behaviors into forms and functions.

Communication Matrix (Rowland, 1990, 1996, 2004 [32]; Rowland & Fried-Oken, 2010; [33]) has the provision for arranging communication forms and functions in a hierarchy based on age of occurrence. Communication matrix allows for recording forms like body movements, vocalizations, facial expression, gestures, symbol use and language. In addition, it also allows for recording the functions of the communication behaviors ('Refuse', 'Obtain', and 'Social interaction' and 'Provide information') andclassifies the forms into seven main levels beginning from the pre-intentional pre-symbolic behaviors to use of symbolic communication behaviors and language.

Communication Complexity scale (CCS) by Brady et al. (2012) [1], is a criterion referenced scale unlike Communication matrix which is a norm referenced scale. CCSwas developed to compare communication behaviors across children with intellectual and developmental disabilities who were primarily pre-symbolic communicators. CCS allows for an expressive communication summary score, based on the most sophisticated communication behaviors demonstrated by an individual, independent of the contexts. CCS addresses subtle developmental aspects to grade presymbolic and symbolic communication forms in a hierarchical continuum like a) succession of eye gaze and other orientation behaviors from single orientation followed by dual orientation and ultimately triadic orientation. b) Developmental sequence of the use of communication behaviors such as vocalization, gestures to the use of symbolic communication behaviors such as words, signs and multi-symbol communication behaviors. c) Use of a single potentially communicative behavior followed by use of multiple communicative behaviors. Thus the scale has specific gradations for presymbolic communication behaviors which most of the contemporary scales lack.

Brady et al, (2012) [1] used CCS to assess communication behaviors in three groups of children, a) preschool-age children with intellectual and developmental disabilities (identified candidates for use of AAC; n = 93); b) Infants 10–36 months of age with moderate-to-severe motor impairments (candidates for directed eye gaze intervention; n = 28); c) Individuals with severe and multiple disabilities and suspected vision impairments of various ages (n = 43). Twelve scriptedcommunication opportunities between examiner and child were coded and the responses to the opportunities were scored using CCS. The same participants were also assessed using the Mullen Scales of Early Learning (MSEL) (Mullen, 1995 [36]) and Expressive scale of preschool language scale (PLS) (Zimmerman, Steiner, & Pond, 2011 [37]) to establish concurrent validity. In addition, concurrent validity between the CCS and Communication matrix (Rowland &Fried-Oken, 2010 [33]) was also demonstrated. The study concluded that the CCS is useful for describing the levels of pre-symbolic and symbolic communication in clinical groups of children.

Christensen (2014 [38]) assessed intentional communication in thirty typically developing infants ina longitudinal study using the CCS. Children's interaction with the examiner were video recorded twice at 7 and 11 months of each child. Because the procedures used to present opportunities varied from those used during the development of the CCS (Brady et al., 2012 [1]), necessary modifications to the original coding guidelines were madeincluding a) Further codification of "physical orientation" and "potentially communicative behaviors" (PCBs) b) Addition of more PCBs (For example, banging toys on the table, shaking the toy, handing the toy to the examiner) in addition to behaviors demonstrating physical orientation. c) A score of 1 (i.e., alerting) to 5 (i.e., dual orientation) was used to indicate pre-intentional communication, while a score of 6 (i.e. triadic orientation) or higher was used to indicate intentional communication. A single score representing the child's overall communication status was arrived at by taking an average of the three highest scale scores recorded in a scripted protocol, as described by Brady et al. (2012) [1]. However, the study failed to demonstrate construct validity for CCS, as there was no significant difference in the means of three highest scores on CCS between the two age groups. Neither was there any significant difference in the mean scores between the two age groups, when all the communication opportunities were considered. Christensen (2014) partially reasoned the poor construct validity of CCS to extraneous variables like interest of the participants' family in communication, inconsistency in administration procedures of scripted protocol.

Poor construct validity of CCS as indicated by Christensen (2014) [38] could also be reasoned based on noprovision in CCS to record deictic gestures and symbolic gestures separately (Deictic gestures are reported to occur prior to symbolic gestures by Rowland and Fried-Oken, 2010 [33]). In the CCS, pantomime gestures, for example, turning one's hand as if unscrewing a lid is considered as PCB. Pantomime gestures indicate a particular semantic content (action of unscrewing the lid) similar to actions such as cupped hand to mouth to represent "drinking" which are considered as symbolic gestures (Crais, Douglas & Campbell , 2004 [14]). Hence, pantomime gestures need to be considered as symbolic gestures and not as pre symbolic gestures. However, in the CCS, there is no provision for differentiating deictic gestures as pre symbolic communication behaviors and symbolic gestures as symbolic communication behaviors. This could be one of the reasons why the results in Christensen (2014) [38] did not support good construct validity of CCS.

Brady, Thiemann-Bourque, Fleming, & Matthews (2013) [39] used CCS to investigate a model of language development for nonverbal preschool-age children learning to communicate with augmentative and alternative communication (AAC). The scale was used in the analyses of communication behaviors in scripted communication samples.Twelve communication opportunities were presented to each child, six to 'request' and six to 'comment'. The average of the three opportunities with highest scores was used as each participant's CCS score in the analyses. The study showed the usefulness of CCS in assessing early symbolic development in children with intellectual disabilities learning AAC.

In summary, early communication in children and infants can be measured through parent report measures, measures of overall development, and behavioral language measures and so on. CCS by Brady et al., (2012) [1] modified by Christensen (2014) [38] is a behavioral measure and is advantageous over the

othersbecause: [a] there is provision to document single communication behaviors, as well as different patterns of pre-symbolic communication behaviors that can occur as a behavioral complex. [For example, Score 2- single orientation (such as looking for the sound source) Score 4 - single orientation with more than 1 PCB (such as looking for the sound source and vocalizing and reaching towards the object). [b] There is scope to code two aspects of communication behaviors: (i) Orientation behaviors in any of the four modalities; visual, tactile, physical and proximity. All these can be assessed/coded at three levels of orientation: single, dual and triadic orientation. (ii) PCBs can be coded at two levels of occurrences: single PCB and more than one PCB. The CCS provides scope for combining these two aspects in a hierarchy for the pre symbolic communication behaviors. (E.g., score 2- single orientation, score 3- single orientation with 1 PCB, score 4- single orientation with >1 PCB, score 5- dual orientation, score 6- triadic orientation, score 7- dual orientation with 1 PCB, score 8- dual orientation with >1 PCB, score 9- triadic orientation with 1 PCB, score 10- triadic orientation with >1 PCB). Considering the unique features of the scale to describe the communication behaviors of children, Communication Complexity Scale (CCS) by Brady et al., (2012) [1] modified by Christensen (2014) [38]was adapted and used in the present study. In the present study, the CCS is adapted to analyze the communication behaviors in two TD children of 1.6 years chronological age in free-play interaction context between mother and child dyad.

1. Need for the study

CCS was developed for assessment of communication in individuals with intellectual disabilities and developmental disabilities who are mostly presymbolic communicators, but is not used successfully with TD children. So the present study aims to use CCS to score TD children of 1.6 years age.

CCS is used to analyze communication behaviors in the interactions between the examiner and child in scripted interaction context (Brady et. al., 2012 [1]; Brady, Thiemann-Bourque, Fleming, & Matthews, 2013 [39]; Christensen, 2014 [38]). Scripted interactions of child with the examiner are "highly structured" (Vandereet, Maes, Lembrechts, & Zink, 2010 [40]) and are appropriate in group research designs, to maintain internal validity and minimize extraneous variability caused by differences in the communication partner's inherent nature and manner of communication with children. However, in clinical practice, scripted interactions need not be a pre-requisite, as parents under guidance are often considered good and reliable "elicitors" of their children's behaviors (Crais et al., 2004 [14]). It can be reasoned that parents are familiar with the contexts in which a particular communication behaviors is exhibited by the child, so they are capable of creating similar contexts to elicit the behaviors. In the process, the children are provided an opportunity to show a behavior in familiar context (Werner &Kaplan, 1963), even if the children have not learnt to de-contextualize and use the gesture in novel contexts. Thus considering the lack of research using CCS involving mother-child dyads, studies in this direction is warranted. The present study is one of the first attempts to adapt modified CCS (Brady et al., 2012 [1]; Cristensen, 2014 [38]) for analyzing communication behaviours in free-play interaction between TD children and their mothers.

2. Present study

The aim of the study was to analyze the pre-symbolic and symbolic communication behaviors of two typically developing children with mean age of 1.6 years in unscripted free-play interaction context with their respective mothers adapting the communication complexity scale (Brady et al., 2012 [1]; Christensen, 2014 [38]).To achieve the aim of the study the following objectives were considered:

a) To represent the communication behaviors of 1.6 year typically developing children elicited in free-play mother child interaction on adapted Communication Complexity Scale (CCS).

b) To analyze the types and frequency of occurrence of single PCBs or single symbolic communication behaviors with single, dual and triadic orientation.

c) To analyze the types and frequency of occurrence of combination of different types of PCBs or symbolic communication behaviors with single, dual and triadic orientation.

II. METHOD

***2.1 Participants*:** Two typically developing female children (Child K and Child S) with their respective mothers participated in the study. The demographic details of the mother child dyad is shown in table 1.

Table 1: Demographic details of mother-child dyads

Socio-demographic details	Mother-Child K dyad	Mother-Child S dyad
Age of the child as on the first day of video recording	1 year 6 months 5 days	1 year 5 months 20 days
Age of the mother as on the first day of	30 years, 2 months	29 years, 8 months

recording		
Educational status of the mother	Post graduate	Post graduate
Occupation	Pursuing doctoral degree	Pursuing doctoral degree
Native language to which the child was exposed since birth	Kannada	Kannada
Socio-economic status of the dyad, assessed as per the Socio-economic status scale	Middle socio-economic status	Middle socio-economic status

The participants of the study were recruited from Mysore, as the study was conducted in Mysore city of Karnataka state, India. Data collection from the dyad was initiated after following the ethical guidelines for bio-behavioral research involving human subjects prescribed by All India Institute of Speech and Hearing, and written consent was obtained from the participating mothers. Through interview, it was ensured that the mothers did not have any sensory, motor and intellectual impairment. The High Risk Register (developed at All India Institute of Speech and Hearing, Mysore) was administered on the children to identify risk factors if any in the prenatal, natal or post-natal periods for developing communication disorders. Assessment across domains such as self-help, social, motor, cognitive, sensory, speech and language and play was carried out using the checklists to assess preschool children with communication disorders (0-6 years) (Swapna, Jayaram, Prema, &Geetha, 2010 [31]). Both the children obtained age appropriate scores corresponding to 1.4 to 1.6 years in all the domains evaluated. They were also screened using the Receptive Expressive Emergent Language Scales (REELS) (Bzoch& League, 1971 [42]) for language comprehension and expression and the children scored in the range of 15 to 18 months for comprehension and expressive language abilities. A brief oral motor examination on the children ruled out the presence of structural or functional oral abnormalities.

A questionnaire was developed to elicit the information regarding the language environment of the children. The responses of the mothers were obtained on a 4 point rating scale as: [1] rarely occurring = 0 to <25% of the total time; [2] occurring sometimes = $\geq$ 25% to < 50% of the total time; [3] occurring most often = $\geq$ 50% to < 75% of the total time; [4] occurring always = $\geq$ 75% to < 100% of the total time. The responses of the mothers are listed in Table 2.

Table 2: Responses of the mothers to the questionnaire on language environment of the children

Sl. No.	Questions	Mother-child K dyad		Mother-child S dyad	
		Response	% of time spent	Response	% of time spent
1.	Are you working for a job/otherwise?	Yes		Yes	
2.	How much time do you spend with the child when the child is awake?	8 hours			12 hours
3.	Who takes care of the child in your absence?	Day care		Grand parents	
4.	How is your time distributed across the activities when the child is awake? Provide details				
a)	Playing with the child with toys, reading or singing to the child, storytelling to the child etc.	Mostly	50-75% (5 hours 55.6%)	Mostly	50-75% (4 hours 50%)
b)	Involving the child in routine activities like feeding, dressing, bathing.	Sometime	25-50% (2 hours 22.2%)	Sometime	25-50% 3 hours 43.7%)
c)	Carrying out household chores and looking after the child	Rarely	0-25% (2 hours 22%)	Rarely	0-25% (30 mins 6.3%)
5	Do you speak in any other language than the native language with the child? If yes, Name the language(s)	English, Telugu		English	
6	If you use more than one language with your child, please specify how often the other language is used.	Rarely	0-25%	Rarely	0-25%
7	How often is the child spoken to, when	Mostly	50-75%	Mostly	50-75%

	awake?				

2.2 Setting

The data was collected from the dyad's respective homes. A silent room in the house with minimal auditory and visual distractions and optimal lighting and ventilation was chosen for data collection. The seating of the participants was on the matted floor. The mother and child were seated on the floor facing each other. A single camera was placed in front of them at a distance of 1.5 to 2 meter on the tripod stand to record the video samples. The movement of the child or mother if any was also captured by adjusting the camera height and position appropriately. It was ascertained that the area of data collection had no distracting objects placed within the child's reach.

2.3 Instruments

A handy-cam (Sony DCR-SR88 with 60X optical zoom and 120 GB memory model) with a tripod stand was used to record audio-visual data. Corel draw graphic suite X6 was used to edit the video samples. The software package EUDICO Linguistic Annotator, ELAN (in short) version 4.9.1 (Sloetjes&Wittenburg, 2008 [43]) was used to annotate the data.

2.4 Task

The task employed was semi-structured, unscripted free play interaction. Mothers were instructed to interact with the child as naturally as possible using one toy at a time. Four toys from the toy kit for infants with developmental disabilities (Venkatesan, 2004 [44]) with additional five age appropriate toys were used. The toys were categorized into three groups 1) Toys which resemble miniature items e.g., toy cheetah, colored elephant, mickey mouse 2) Toys which change physical forms on manipulation –rings that could be stacked on a stand, cubes that could be built into tower and other forms, colored blocks which could be joined or detached 3) Toys which produced noise on manipulation-xylophone, drum with sticks, office bell.

2.5 Recording

The video recording was carried out through overt observation method and using a non-participatory design. The interaction between the mother and child dyad was recorded in three sittings (minimum of 20 minutes in each sitting) with different toys.

2. Procedure

The initial part of the data collection involved collecting the socio-demographic details from the participants and administering the questionnaire for documenting the language environment of the children, determining the language age of the child and skills in cognitive, motor, sensory and communication domains. Following this, a 20 minute video recording of the interaction between mother and child was collected in the first sitting. A break of 10 minutes was given before the second recording, which was carried out on the same day. The third recording was carried out the next day. Overall, a 60 minutes duration video sample was obtained from each mother child dyad.

3.1 Analysis

Video samples were edited to select interaction samples with most meaningful interaction occurring between the mother and child. Attempt was also made to select similar interaction samples from both dyads. Following this criteria, the final analysis of mother-child interaction samples of both the dyads was reduced to approximately 9 minutes. The analysis of the samples was carried out in three levels: In the first level videos with instances of no interaction between mother and child due to crying of the child, moving of the child out of the camera focus were eliminated. In the second level the most meaningful interaction samples elicited using the 9 different toys were arranged in a single track using a common sequence of interaction. In the third level of analysis, the best interaction between mother and child dyad were chosen, thus a 9 minute long sample was retained for further analyses from each dyad (details of level 1,2,3 of analyses available from the author on request)

3.2Data Annotation

The video samples of the mother-child interaction were annotated using EUDICO Linguistic Annotator (ELAN) version 4.9.1(Sloetjes&Wittenburg, 2008 [43]) software and scored based on the adapted CCS. Prior to annotation, the data was segmented as mother's communication turns and child's communication turns, based on the definition of potentially communicative behaviors (PCB) in the Communication complexity scale (Brady, et al, 2012; Christensen in 2014). Each child's communication turn was annotated using a multidimensional annotation framework whichincludedannotation of: a) Eye gaze b) Gesture (body movements, ritualized

gestures, deictic gestures, representational gestures) and/or facial expression c) vocalizations and d) verbal behaviours occurring in each child's communication turns. The annotated communication turns was assigned scores as in the CCS manual (Brady et al., 2012) with appropriate adaptations.

3.3 Adaptations made in the present study in the CCS (Brady et al., 2012 [1]) protocol for the analysis of scripted free-play interaction between mother and child.

In the study by Brady et al., (2012) [1], each script contained at least twelve communication opportunities to elicit a target communication behavior from the child. The average time for each opportunity was about 30s. In the present study, meaningful free-play interaction samples were elicited using 9 different toys. A total duration of 9 minute mother-child interaction sample (with 60 second interaction for each toy) was considered for analyses. A total of 69 and 66 communication turns of child K and child S respectively were scored on adapted CCS.

Brady et al., (2012)[1] summed the scores from 12 scripted assessment protocol, which was considered the highest scored communication behavior observed in each opportunity. To arrive at a single score, an average of the three highest scores from the scripted protocol was considered for each participant. In the present study, no measure of central tendency is used, the scores are represented on bar graph with abscissa representing the 13 scores of adapted CCS and the ordinate representing the frequency of occurrence of scores on CCS. This was carried out because the raw scores provided a better opportunity to compare the frequency of occurrence of the behavior, the forms of communication behaviors used and the combinations used by the two children.

The salient adaptations made in the scoring of the behaviours in CCS (Brady et al 2012) [1], in this study are as follows:

1. The gestures listed as PCBs in the CCS (Brady et al., 2012) [1]mostly comprised of deictic gestures. However, pantomime gestures are also considered as PCB and the occurrence of these pantomime gestures are considered as pre-intentional or intentional nonsymbolic rather than symbolic communication behaviours. There is no demarcation for deictic and symbolic gestures. Therefore in the present study only deictic gestures (ritualized behaviours) and vocalizations were considered as PCBs. Symbolic gestures were not considered as PCBs and were accounted for with scores of 11, 12 or 13 under intentional symbolic (IS) communication behaviours.
2. The term nonsymbolic is replaced by the term presymbolic in the CCS (Brady et al., 2012) [1]. The reason for this replacement is that in the literature it has been demonstrated that nonsymbolic communication behaviors proceed symbolic communication behaviors. The term nonsymbolic is more suitable for children with developmental disabilities or intellectual disabilities as some may never reach symbolic communication but it is not the case in typically developing children.
3. As the present study considered typically developing children, the augmentative and alternative mode of communication was not used. So, the sections in the CCS (CCS (Brady et al., 2012 [1]) which describe the use of SGDs, PECS or any other AAC symbol selection strategies, were ignored.
4. In CCS (Brady et al., 2012 [1]) score 11 is assigned for the use of speech to communicate and score 12 for the use of multiple words. As per the instructions in CCS, there is no scope to represent accompanying deictic or symbolic gesture with speech. Both the children in this study produced deictic gestures in combination with the words. This is in line with the observations made by few investigators that children produce their first gesture + word sentences before their first word + word sentences (Goldin-Meadow, Goodrich, Sauer, & Iverson, 2007 [45]). There is no provision in CCS to document such combinations. In order to report use of symbolic or deictic gestures along with speech or symbolic gesture the operational definition was modified for score 11 and score 12. Score 11 was re-defined as use of one or more speech utterance or symbolic gesture with one or more PCBs. Score 12 was re-defined as use of single speech utterance or a single symbolic gesture. To record the use of combination of two or more spoken words or use of spoken words with symbolic gestures or use of two or more symbolic gestures, score 13 was introduced. Thus, a child's use of combination of both symbolic and presymbolic patterns of communication behaviours, a single symbol use and a combination of symbolic only patterns of communication behaviours were scored separately.
5. In order to document the scores, a standard multidimensional protocol for the annotation of child's communication turns was used. Once the communication turns were annotated, scores were assigned to each of the communication turns based on the adaptations made as shown in points 1 to 5 above.

3.4Inter-judge reliability:The video samples were annotated and coded by the first investigator as the first coder for various communication forms. The reliability of the annotations and codes were checked by another /coder, who was a speech language pathologist. The second coder was trained by the investigator to annotate the video samples and assign scores on the 13 point rating scale of the adapted CCS in this study. The training lasted for

approximately three hours using sample videos which were not part of the data. The annotations of the first and second coder were compared for each communication turn and a point-by-point agreement and disagreement was marked on each aspect annotated for each communication turn. Remarks on any disagreement of the communication turn were noted. For communication behaviors of child K, a 94.047% agreement was obtained and 5.052% disagreement was noted. For child S, an agreement of 92.307% was obtained and 7.692% of the annotations were not agreed upon. In the next step, the scores (on a 13 point rating scale) offered for annotations by the investigator were compared with the scores offered by the second coder. Point-by-point agreement and disagreement was marked for each communication turn. There was 90.47% agreement for child K's ratings and 9.53% were disagreements; for child S there was 87.69% agreement and 12.31% disagreement.

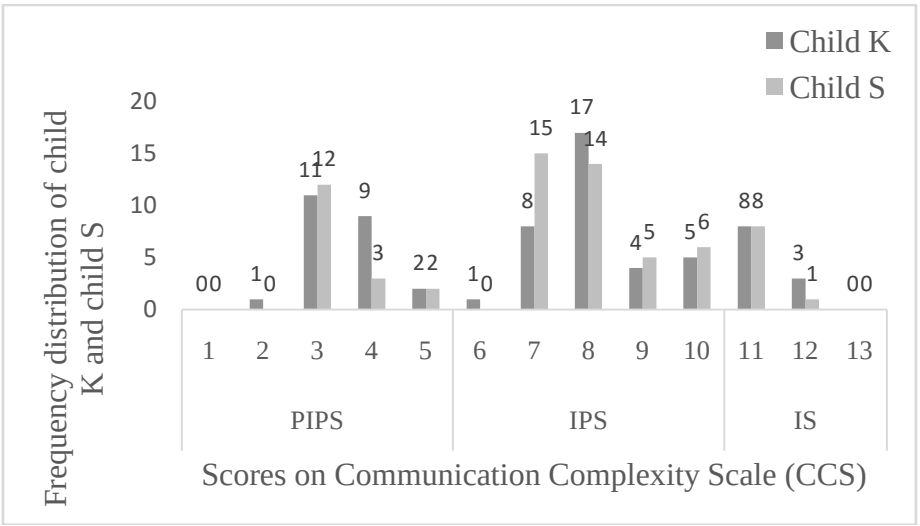
III. RESULTS AND DISCUSSION

The annotated communication turns of the children were scored on the 13 scores of adapted CCS. The communication behaviours of the children (communication turns) which occurred in dyadic context with their respective mothers were considered for scoring. Description of scores on the adapted CCS is given in table 3.

Table 3: Adapted Communication Complexity Scale

Scores	Description
Score 0	No Response
Score 1	Alerting behaviors
Score 2	Single object/event/person orientation
Score 3	Single object/event/person orientation with 1 PCB
Score 4	Single object/event/person orientation more than 1PCB
Score 5	Scanning between objects/events Or Dual orientation between a person and an object or event
Score 6	Triadic orientation
Score 7	Dual orientation with 1PCB
Score 8	Dual orientation with more than 1PCB
Score 9	Triadic orientation with 1 PCB
Score 10	Triadic orientation with more than 1 PCB
Score 11	Combination of Presymbolic and symbolic behaviors
Score 12	Single symbolic behaviors
Score 13	Multi symbolic behaviors

4.1 Representation of the communication behaviors of child K and child S on adapted CCS



[*PIPS- Pre-intentional presymbolic communication behaviors; IPS- Intentional presymbolic communication behaviors, IS-Intentional symbolic communication behaviors]

Figure 1: frequency of occurrence on 1 through 13 scores of adapted CCS for child K and child S in free play mother-child interaction

4.1.1 Pre-Intentional Pre-symbolic (PIPS) Communication Behaviors (Score 1 through score 5)

From fig 1, Child K displayed 'Single object/event/person orientation plus 1 PCB (score 3) in eleven instances and child S in twelve instances.Child K displayed Single object/event/person orientation and more than 1PCB (Score 4) in nine instances. Child S displayed the behavior in three instances. Both children displayed'Dual orientation' (score 5) in two instances. Child K showed 'single orientation' (score 1) once. There were no behaviors that could be scored as alerting behaviors by child K or child S.

4.1.2 Intentional Pre-Symbolic (IPS) Communication Behaviors (Score 6 through Score 10)

Child K displayeddual orientation accompanied with more than 1 PCBs(Score 8) in seventeen instances and 'Dual orientation with single PCB' (score 7) in eight instances. On the other hand, child S displayed 'Dual orientation with single PCB' (score 7) in fifteen instances and 'Dual orientation with more than 1PCB' (score 8) in fourteen instances. Child K and S displayed 'Triadic orientation with more than 1 PCB' (score 10) in five and six instances respectively. Child K and S displayed 'Triadic orientation with single PCB' (Score 9) infour and five instances respectively. Child K displayed 'Triadic orientation' (Score 6) only once.

4.1.3 Intentional Symbolic (IS) Communication Behaviors (Score 11 through Score 13)

Both the children, showed 'Combination of Presymbolic and symbolic behaviors' (Score 11) in eight instances. Child K displayed 'single symbolic communication behavior' (Score 12) in three instances and child S displayed only once. The behavior of 'combination of one or more symbolic communication behaviors' (Score 13) were not seen to occur in both the children.

From Figure 1 and the above results, it can be inferred that among the 13 scores on adapted CCS, frequency of occurrence in Child K and child S were similar (difference in the frequency on a score for child K and child S was 1) for 7 different behaviors/complexes. The 7 communication behaviors/complexes of CCS were; Single object/event/person orientation (Score 2); Single object/event/person orientation with 1 PCB (Score 4); Scanning between objects/events or Dual orientation between a person and an object or event (Score 5); Triadic orientation (Score 6); Triadic orientation with 1 PCB (Score 9); Triadic orientation with more than 1 PCB (Score 10); Combination of Presymbolic and symbolic behaviors and Multi symbolic behaviors (Score 11). The 4 behaviors/complexes on CCS which children had dissimilar frequency of occurrence (the difference in the frequency on a score for child K and child S was 2 to 7) were Single object/event/person orientation with more than 1 PCB (Score 4); Dual orientation with 1 PCB (Score 7); Dual orientation with more than 1 PCB (Score 8) and Single symbolic behaviors (Score 12). There were no behaviors/complexes that could be scored as Alerting behaviors (Score 1) and Multi symbolic behaviors (Score 13) in both children.

In PIPS category, both children had single orientation with 1PCB (Score 3) as the most frequently occurring complex. Child K displayed 11 instances and child S, 12 instances on this complex. Child K displayed Single orientation (Score 2) only once. Both children did not display alerting behaviors (Score 1). Thus single orientation (Score 2)was the least occurring behaviors among PIPS category. In IPS category, Child K displayed a frequency of 17, as the highest frequency on Dual orientation with more than 1PCB (Score 8) and child S a frequency of 15, as the highest frequency on dual orientation with 1 PCB (Score 7). These frequencies were the highest not only in IPS category but also among the three categories namely PIPS, IPS and IS and 13 behaviors/complexes of adapted CCS. Child K displayed triadic orientation (Score 6) only once and child S did not display any. Thus triadic orientation only was the least frequently occurring behavior in IPS category for child K and triadic orientation with 1 PCB (Score 9) for child S. In IS category, both children displayed combination of presymbolic and symbolic behaviors (Score 11) as the most frequently occurring complex. This complex was observed in 8 instances in both children. Both children did not display combination of multiple symbolic behaviors (Score 13). Single symbolic behaviors (Score 12) was the least occurring for both child K and child S in IS category.

Thus from the above results, two interesting observation may be noted, both children displayed mostly similar trend in the frequency distribution across adapted CCS. The behavioral complexes comprising PCBs were the most frequently occurring in all the three categories (PIPS, IPS and IS). In contrast complexes without PCBs were least occurring. This observation supports Wetherby et al, 1988 [11], who demonstrated that 18 months olds use a combination of gestures, vocalizations and words or word approximations. The similarity in the frequency distribution of communication behaviors/complexes in the two children can be attributed to the similarity in the different domains of development in both the children such as social, cognition, motor, sensory, speech and language, play which corresponded to 1.4 to 1.6 years as evaluated by checklists to assess preschool children with communication disorders (0-6years) (Swapna, Jayaram, Prema, &Geetha, 2010 [31]) and similar socio-demographic backgrounds of the mothers (Table 1) and the language environment of the children (Table 2). These domains of development, socio-demographic backgrounds and language environment have influence on communication as a whole. In addition, both the children did not display behaviors that could be categorized

under alerting behaviors (Score 1). The probable reason could be that the children have outgrown the stage of exhibiting alerting behaviors and have developed to the further stages of communication. In the further stages of communication, the reason for use of PCBs with orientation pattern could be that, use of any PCB makes the communication more specific in the context of its occurrence than orientation patterns without PCBs.

From the above results it can also be inferred that, the adapted CCS can be used not only with children with developmental disabilities as demonstrated by Brady et al., (2012) [1] or with nonverbal preschool-age children learning to communicate with augmentative and alternative communication (AAC) as demonstrated by Brady et al. (2013) [39] but can also be successfully adapted to use with typically developing children. The adaptation can be for the use of CCS in the context of free play unscripted mother child interaction, in contrast to the former studies, which were done in the context of scripted examiner-child interaction. CCS can not only be used in primarily presymbolic communicators but also with communicators who use a combination of both presymbolic and symbolic communication behaviors like TD children in the age of 1.6 years. However, as the present study was done on only two typically developing children, and both mothers were educated and came from the middle socio-economic status, more studies with greater number of participants and mothers with different socio-economic backgrounds is warrantied to confirm the usefulness of adapted CCS for free play mother child interaction.

4.2 Types and frequency of occurrence of single PCBs and single symbolic communication behaviors with single, dual and triadic orientation.

The types and frequency of occurrence of single PCBs (deictic gestures,conventional gestures, and vocalization) or single symbolic communication behaviors (proto-words, words) with the three orientation patterns- single, dual or triadic orientation were analyzed and presented in figure 2. The orientation patterns need not be specified on the three IS behaviors (combination of presymbolic and symbolic communication behaviors, single symbolic communication behaviors and combination of symbolic communication behaviors which is score 11, 12 and 13 respectively) as per the adapted CCS. However, in this study thesingle symbolic communication behaviors are classified under three orientation patterns.

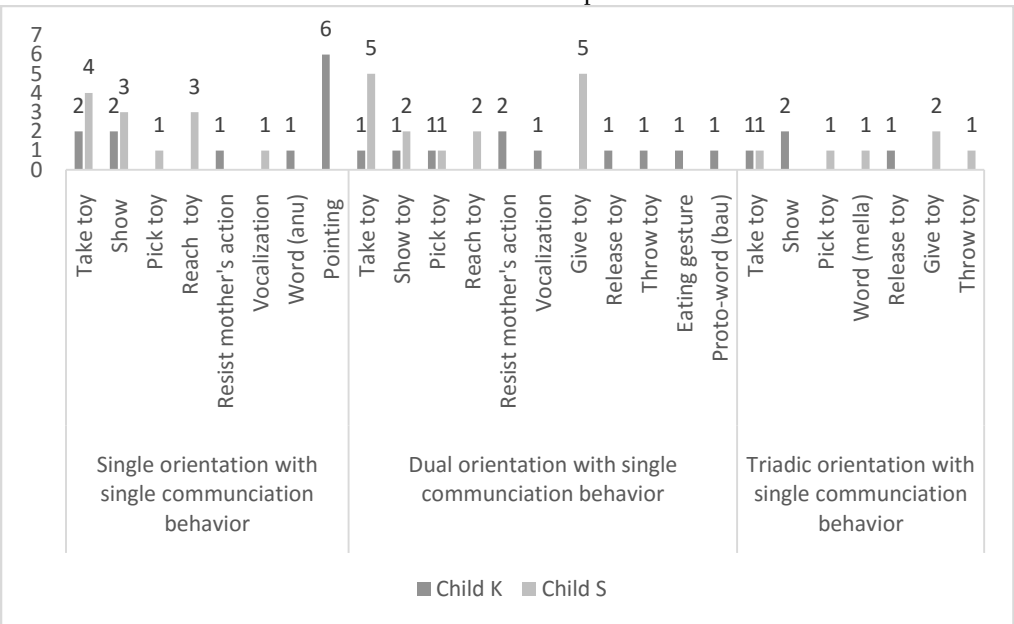


Figure 2: Types and frequency of occurrence of single PCBs (single symbolic communication behaviors) with different gaze orientation patterns in child K and child S

As seen from the fig 2, Out of eight different types of communication behaviors considered under PIPS, (Take toy, show, pick toy, reach toy, resist mother's action, vocalization, 'a:nu' <elephant>, pointing) used by both the children in single orientation category, three types were used exclusively by child K (resisting mother's action, 'a:nu'<elephant> and pointing) in 8 instances, and three types were used exclusively by child S (pick toy, reach and vocalization) in 5 instances. Two types were used by both the children (take toy, show), child K used in 4 instances and child S in 7 instances. Out of the eight types of communication behaviors only one type was symbolic and it was used by child K ('a:nu'<elephant>) in a single instance.

The types of communication behaviors observed with dual orientation were more than that noted in single orientation. Out of the 11 types(Take toy, show, pick toy, reach toy, resist mother's action, vocalization, give, release, throw toy, eating gesture, 'bau'<dog bark>) of communication behaviors considered as IPS anddisplayed by both children, three types (take, show, pick toy) were used commonly by both the children, child K used the three types in 3 instances and child S in 8 instances. Six types (resist mother's action,vocalization, release toy, throw toy,eating gesture, 'bau' <dog bark>) were seen exclusively in child K in 7 instances and two types (reach, give toy) were seen exclusively in child S in 7 instances. Thus, it is interesting to note that overall in dual orientation category, Child K displayed more types than child S (Child K -9 types and child S -5 types). However, the frequency of occurrence of single communication behaviors for child S was greater than for child K (Child K- frequency of 11; child S frequency of 25).Out of the 11 types of communication behaviors, nine were presymbolic and the rest two types were symbolic communication behaviors and were displayed by child K.

In triadic orientation considered under IS, the total types of communication behaviors observed in both the children were seven (take, show, pick toy, 'mella' <slowly>, release toy to mother's grasp, give toy, throw toy). Out of seven, two types (show, release toy) were exclusively seen in child K and four types (pick toy, 'mella'<slowly>, give toy, throw toy) were exclusively seen in child S and only one type (take toy) wasused commonly by both the children. Overall, in triadic orientation category, child S showed more types and greater frequency (5 types with a frequency of 6) compared to child K (3 types with a frequency of 4).

From the above observations, it can be inferred that child K displayed a total of seven deictic gestures (take, show, pick, reach, resist, release, throw) a vocalization, a conventional gesture (eating gesture), a proto-word ('bau'<dog bark>) and a word ('a:nu'<elephant>). In contrast child S displayed six deictic gestures (take, show, pick, reach, give, throw), a vocalization and a word ('mella'<softly>). The common communication behavior displayed by both child K and child S were four deictic gestures (take, show, pick, throw) and vocalization. On analyses of the use of the communication behaviors with respect to the orientation, child K displayed five communication behaviors in twelve instances in single orientation, nine communication behaviors in eleven instances in dual orientation and three communication behaviors in triadic orientation. Whereas child S displayed five communication behaviors in twelve instances in single orientation, five in fourteen instances in dual and five in six instances in triadic orientation. Thus, with respect tosingle, dual and triadic orientation categories, both children displayed a greater variety of communication behaviors and with greater frequency of occurrence with dual and triadic orientation put together than in single orientation. This tendency indicates that both children are mostly intentional communicatorsas the dual and triadic orientation patterns and combination of communication behaviors with symbolic component are listed under intentional presymbolic (IPS) and intentional symbolic (IS) respectively.However, it cannot be ignored that both children have not completely stopped the use of pre-intentional communication, though the type and frequency of occurrences are lower.

4.3 Types and frequency of occurrence of combination of different PCBs or symbolic communication behaviors with single, dual and triadic orientation.

In the adapted CCS, occurrence of combination of more than one PCB (deictic gestures, conventional gestures and vocalizations) with single orientation, dual orientation and triadic orientation (scores 4, 8, 10 respectively) and occurrence of one or more PCBs with one or more symbolic communication behaviors (symbolic gestures, proto-words and words) (score 11) and occurrence of multi symbolic communication behaviors (score 13) represent behavior complexes.Table 4, 5, 6 describes the types of PCBs combined by child K and child S and their frequency of occurrence in single, dual and triadic orientation patterns respectively.

4.3.1 Types and frequency of occurrence of combination of different PCBs with the single orientation

Table 4: Components of behavioral complexes with single orientation and frequency of occurrence in child k and child S.

Combination	Child K	Freq	Child S	Freq
D+D	a) Drop toy and reach for the toy	1	a) Pick toy and give to it to the mother,	1
	b) Release toy and reach for toy	1		
	c) Pick toy and reach for the toy	1	b) Drop toy in one hand and pick another toy	1
	d) Take toy and show toy manipulation	1		
	e) Take toy and resist mother's hand over hand for toy manipulation	1		
	f) Pick toy and drop toy	1		

D+V	g) h)	Pick toy and vocalize Reach toy and vocalize	1 1	c) Take toy and vocalize	1
D+D+V	i)	Pick toy, release toy and vocalize	1		

Child K displayed Single object/event/person orientation with more than 1PCB (Score 4) in 9 instances. Two types of combinations were observed, combination of two deictic gestures (D+D) in 6 occasions; combination of a single or multiple deictic gestures with vocalization (D+V or D+D+V) in 3instances. On the contrary, child S displayed Single object/event/person orientation with more than 1PCB (Score 4) in 3 instances. Combination of two deictic gestures (D+D) in 2 occasions and combination of a single deictic gestures with vocalization (D+V) in a single instance.Combination of two deictic gestures with vocalization (D+D+V) was displayed exclusively by child K. Child K displayed seven deictic gestures in three different combinations and these gestures were drop, reach, release, pick, take, show, resist mother's action. On the contrary child S displayed four deictic gestures pick, drop, give toy and take toy in two different combinations. Child K and child S used three deictic gestures in common which were drop, pick, and take toy.

4.3.2 Types and frequency of occurrence of combination of different PCBs with the dual orientation

Table 5: Components of behavioral complexes with dual orientation and frequency of occurrence in child k and child S.

Combination	**Child K**	**Freq**	**Child S**	**Freq**
D+D	a) Pick toy + Show toy manipulation b) Whole hand point on toy's mouth + Point to own mouth c) Take toy+ Drop toy on mother's lap d) Show toy manipulation + Drop toy e) Reach toy+ Pick toy from ground	3 1 1 1 1	a) Pick toy + give toy b) Give toy + take toy c) Pick + Show d) Take toy + Show toy manipulation e) Take toy + push away toy f) Pick + Give	3 1 1 1 1 1
D+D+D	f) Drop toy + Pick toy + Resist mother's offer of toy	1	g) Show toy + Pick toy + Reach toy	1
D+C	g) Rocking with joy+ Index finger pointing	2	h) Show toy manipulation + Sway head on drum beat	1
D+V	h) Show toy manipulation + Vocalization i) Index finger pointing contact + Vocalization j) Resist hand over hand for sitting + Vocalization	2 1 1	i) Show toy manipulation + Vocalization j) Reach toy + Vocalization k) Point with stick + Vocalization l) Show + Vocalize	1 1 1 1
D+D+V	k) Reach toy + Take toy + Vocalization l) Release toy to mother + Take toy + Vocalization m) Head point + Vocalization + Index finger pointing	1 1 1	-	

Child K displayed dual orientation with more than 1PCB (Score 8) in 17 instances. Three types of combinations were observed, combination of two or more deictic gestures (D+D, D+D+D) in 8 occasions; combination of a deictic gesture with a conventional gesture in 2 instances; combination of single or multiple deictic gestures with vocalization (D+V or D+D+V) in 7 instances. Combination of two deictic gestures with vocalization (D+D+V) was displayed exclusively by child K. On the contrary, child S displayed dual orientation with more

than 1PCB (Score 8) in 14 instances. Combination of two or more deictic gestures (D+D, D+D+D) in 9occasions; combination of deictic gesture with conventional gestures in 1 instance and combination of a single deictic gesture with vocalization (D+V) in 4 instances. Child K displayed eight deictic gestures in five different combinations and these gestures were drop, reach, release, pick, point, take, show, resist mother's action and a conventional gesture of rocking with joy. On the contrary Child S displayed seven deictic gestures, pick, give, show, reach, push, point and take toy and a conventional gesture of swaying head to the drum beat in four different combinations. Child K and child S used five deictic gestures in common which were pick, point, show, reach, and take.

4.3.3 Types and frequency of occurrence of combination of different PCBs with triadic orientation

Table 6: Components of behavioral complexes with triadic orientation and frequency of occurrence in child k and child S.

Combination	**Child K**	**Freq**	**Child S**	**Freq**
D+D	a) Pick toy + show toy manipulation	1	a) Take toy + give toy	1
D+C	-		b) Give toy + swing with song	1
D+V	b) Show toy manipulation + Vocalization c) Pick toy+ vocalization d) Take toy+ vocalization	1 1 1	c) Point to toy + Vocalization	1
D+D+V	-		d) Push away toy + reach toy + 3vocalization e) Pick toy + give toy + vocalization	1 1
D+C+V	Pick toy+Hands extended with toy for help + vocalization	1	-	
D+D+D+C	-		f) Give toy + Clap + pick toy + kick toy	1

Child K displayed triadic orientation with more than 1PCB (Score 10) in 5 instances. Three types of combinations were observed in child K, combination of two deictic gestures (D+D) in 1occasion; combination of a single deictic gestures with vocalization (D+V) in 3 instances; combination of a deictic gesture, a conventional gesture and vocalization in 1 instance which was a unique complex displayed by only child K. On the contrary, child S displayed dual orientation with more than 1PCB (Score 10) in 6 instances. Combination of two deictic gestures (D+D) in 1occasion; combination of a deictic gesture and a conventional gesture in 1 instance; combination of a single or multiple deictic gestures with vocalization (D+V; D+D+V) in 3 instances. Child S displayed a unique combination of three deictic gestures with a conventional gesture (D+D+D+C) in one instance.Combination of deictic gesture with a conventional gesture and vocalization (D+C+V) was displayed exclusively by child K and combination of two deictic gestures with vocalization (D+D+V) and three deictic gestures with a conventional gesture (D+D+D+C) was the unique combination displayed only by child S. Child K displayed three deictic gestures in three different combinations and these gestures were pick, take, show and a conventional gesture of extending hand with toy for help. On the contrary Child S displayed seven deictic gestures pick, push, point, reach give, take toy and kick toy and two conventional gesture of swaying head to the song and clapping. Child K and child S used two deictic gestures in common which were pick and take toy.

4.3.4 Types and frequency of occurrence of combination of different PCBs and symbolic communication behaviors

Table 7: Components of behavioral complexes with PCBs and symbolic communication behaviors and frequency of occurrence in child k and child S.

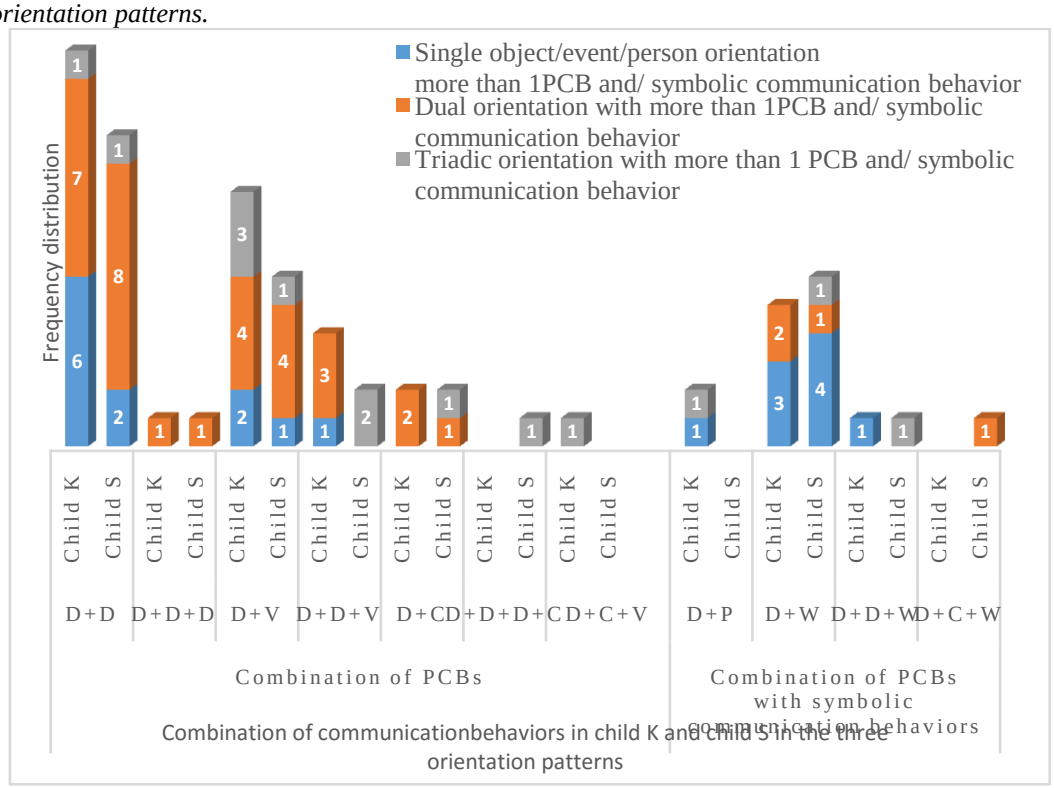
Combination	**Child K**	**Freq**	**Child S**	**Freq**
D+W	a) Point (dual orientation) + a:ku <put> b) Point (Single	1 1	a) Show toy (single orientation) + mella<softly>	1 1

	orientation) + a:nu<elephant> c) Point (Single orientation) + KaNNu<eye> d) Show toy (dual orientation) + koDu<give> e) Give toy (single orientation) + a:na <elephant>	1 1 1	b) show toy manipulation (single orientation) + attempt to make less sound and says mella<softly> c) Point (single orientation) + alli<there> d) Point (single orientation) + KoDu<give> e) Pull toy (triadic orientation) + ida<this> f) beya<don't want>+Kick toy (dual orientation)	 1 1 1 1 1
D+D+W	f) Pick + Throw (Single orientation) + a:na<elephant>	1	g) Pick toy + show toy (triadic orientation) + blu<blue colour>	1
D+P	g) Reach for toy (Triadic orientation) + aumaum<eating> h) Point (Single orientation) + bau<dog bark>	1 1	-	
D+C+W	-		h) Push toy + head shake (dual orientation) + beya<don't want>	1

Child K displayed combination of single or more than one PCB (deictic gestures-D, conventional gestures- C, vocalization-V) with symbolic communication (words- W, proto words- P) (Score 11) in 8 instances. Three types of combinations were observed, combination of one or more deictic gestures with word (D+W; D+D+W) in 6 occasion; combination of deictic gesture with proto word (D+P) in 2 instances. Child S displayed combination of single or more than one PCB (deictic gestures-D, conventional gestures- C, vocalization-V) with symbolic communication (words- W, proto words- P) (Score 11) in 8 instances. Combination of one or more deictic gestures with word (D+W; D+D+W) in 7 occasions; combination of deictic gesture with a conventional gesture and word (D+C+W) in 1 instance. Combination of deictic gesture with protoword (D+P) was displayed exclusively by child K and combination of deictic gestures, conventional gesture and a word was the unique combination displayed only by child S. On further analysis, Child K displayed different 6 deictic gestures in the complexes (Point, show, give, pick, throw, reach), two proto words ('aumaum' <eating>, 'bau' <dog bark>) 4 different words ('a:ku'<put>, 'a:nu' <elephant>, 'koDu' <give>, 'kaNNu' <eye>). Child S displayed 5 deictic gestures (show, point, pick, pull, push), a conventional gesture (head shake) and 5 words ('mella' <softly>, 'alli'<there>, 'koDu' <give>, 'beya' <don't want>, 'ida' <this>).

According to the Local homology model, between 18-20 months there is a growth in vocabulary size and its resultant word combinations, growth in multiword utterances and this growth correlates with the multi-scheme gestural combinations (Thal& Tobias, 1994 [22]). However, in the present study, even though the children were of 18 moths age (Child K 18 months 5 days, Child S 17 months 20 days) both children did not show multiword utterances at all, multi-gestural combination were demonstrated in abundance as depicted in the table 4,5,6,and 7. The possible reasons for this discrepancy may be that, the studies considered to support the model considered children between 18 and20 months of age, but the present study has considered children at 18 months of age. So, before children begin to demonstrate multiword utterances and multi-scheme gestures which are symbolic in nature, there might be a transition stage where the children try to combine the PCBs and then combine PCBs with symbolic communication behaviors. This stage of transition may occur at around 18 months and may not last for a longer period.

4.3.5 *Types and frequency of occurrence of combination of PCBs /symbolic communication behaviors with the three orientation patterns.*



*D- Deictic gesture, V-Vocalization, C- conventional gesture, P-Proto-word, W-word

Figure 3: Types and frequency of occurrence of combination of PCBs /symbolic communication behaviors with the three orientation patterns.

In adapted CCS it is not required to classify the PCBs that occur on score 11, combination with symbolic communication behaviors under the three orientation. However, in the present study these combinations were analyzed and represented under the respective orientation. Figure 3 represents the summary of combinations of PCBs and symbolic communication behaviors and their frequency of occurrence as displayed by child K and child S in single, dual and triadic orientation. In other words, it summarizes the tables 4, 5 6 and 7. From the figure 3 it can be noted thatin single, dual and triadic orientation patterns the two children displayed seven different combinations PCBs which included combination of 1) two deictic gestures (D+D) 2) three deictic gestures (D+D+D) 3) a deictic gesture and vocalization (D+V) 4) two deictic gestures and vocalization (D+D+V) 5) a deictic gesture and a conventional gesture (D+C), 6) three deictic gestures and a conventional gesture (D+D+D+C) 7) a deictic gestures a conventional gesture and vocalization. The two children displayed four combinations of PCBs with symbolic communication behaviors which were 1) a deictic gesture and a protoword (D+P), 2) a deictic gesture and a word (D+W), 3) two deictic gestures and a word (D+D+W) and 4) a deictic gesture a conventional gesture and a word (D+C+W).

Both children displayed greater combinations of PCBs than PCBs with symbolic communication behaviors. With respect to the three orientation patterns in combinations of PCBs, most combinations occurred with dual orientation (5 combinations) followed by equal number of combinations (three combinations each) in single and triadic orientation in child K. In contrast, most combinations occurred with triadic orientation (5 combinations) followed by dual orientation (three combinations) and finally single orientation (two combinations) in child S. Thus, considering the different combinations of PCBs and frequency of occurrence in dual and triadic orientation put together in both children, both children are mostly intentional communicators. However, it cannot be ignored that both children continue to use behavior complexes with single orientation which are considered as pre-intentional communication, to satisfy some of their communication requirements,though the type and frequency of occurrences are lower.

On analyses of the combinations of PCBs and symbolic communication behaviors, it is obvious that in all the combinations, the presence of deictic gestures is common in both children. Further analyses of the deictic gestures revealed thatapart from the deictic gestures listed in the CCS, additional deictic gestures were observed in the children such as shirking the hand away from mother's grasp to resist her action, picking toy from floor, taking toy from mother, and release of grasp of the mother on the toy, showing the toy etc. In other words, it would be difficult to limit the deictic gestures as a set of predefined behaviours. Although few deictic gestures

can be identified easily, in practice however, with careful observation many behaviours/actions of children which serve a communication function may be treated as a deictic gesture. These could occur spontaneously in interaction with communication partner. In other words, deictic gesture types could be an open set. When interaction samples are annotated, it is essential for the investigators to observe, discern and note the actions that occur as a part of child's use of the object and whether it serves any communication purpose/function.

IV. CONCLUSION

With the aim of analyzing the pre-symbolic and symbolic communication behaviors of two typically developing children with mean age of 1.6 years in unscripted free-play interaction context with their respective mothers the communication complexity scale (Brady et al., 2012 [1]; Christensen in 2014 [38]) was adapted.One of the salient adaptations is demarcation of deictic gestures as presymbolic communication forms and symbolic gestures as symbolic forms of communication; and Redefining score 11 as Combination of Presymbolic and symbolic behaviors, 12 as Single symbolic behaviors and introduction of score 13 to represent Multi symbolic behaviors. On application of CCS on the samples of mother-child interaction obtained from Child K and S, it was observed that the frequency of occurrence of behaviours in both children on CCS were strikingly similar. The highest frequency for both children in PIPS behaviors was on score 3 and 4. Highest frequency on IPS behaviors was on 7 and 8 and for IS behaviors, it was on 11. Among PIPS, IPS and IS both children scored highest frequency on IPS. Thus the present study demonstrates successful adaptation of CCS for typically developing children who are predominant users of intentional communication and in the context of free-play mother child interaction. In addition, the similarity in the communication profile of the two children depicted on adapted CCS is attributed to the similarity in the developmental domains of the children, similarity in the socio-demographic backgrounds of the mothers and language environment of the children.

As part of the second objective, the performance of both children were further analyzed to find the types of presymbolic and symbolic communication behaviors that occurred as a single entity along with the three orientation patterns namely single, dual and triadic orientation. Both children displayed a greater variety of communication behaviors and with greater frequency of occurrence with dual and triadic orientation put together than in single orientation, thus the children were predominant users of intentional communication. In addition, though the frequency of occurrence of pre-symbolic and symbolic communication behaviors matched for both children, the types varied significantly.

Third objective of the study was to analyze of the patterns of combination of pre-symbolic and symbolic communication behaviors with single, dyadic and triadic orientation. With respect to the three orientation patterns in combinations of PCBs, most combinations occurred with dual orientation (5 combinations) followed by equal number of combinations (three combinations each) in single and triadic orientation in child K. In contrast, most combinations occurred with triadic orientation (5 combinations) followed by dual orientation (three combinations) and finally single orientation (two combinations) in child S. Thus, considering the different combinations of PCBs and frequency of occurrence in dual and triadic orientation put together in both children, both children are mostly intentional communicators.

Thus both children demonstrated varied strength in their communication behaviors. While the child K displayed strength in terms of greater frequency of usage in pre-symbolic and symbolic forms both in isolation and combination, Child S displayed strength in displaying more number of combination patterns of communication behaviors and also more types of communication behaviors which were combined to form a single complex.

V. ACKNOWLEDGEMENTS

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REFERENCES

[1] Brady, N. C., Fleming, K., Thiemann-bourque, K., Olswang, L., Dowden, P., Saunders, M. D., & Marquis, J. (2012). Development of the Communication Complexity Scale, *American Journal of Speech-Language Pathology, 21*, 16–28.

[2] Oller, D. K. (2000). *The Emergence of the Speech Capacity*. Mahwah, NJ: Lawrence ErlbaumAssociates.

[3] Bates, E., Benigni, L., Bretherton, I., Camaioni, L.,&Volterra,V. (1979). *The emergence of symbols: Cognition and communication in infancy*. New York: Academic Press.

[4] Bates, E., Camaioni, L. &Volterra, V. (1975). *The acquisition of performatives prior to speech*. Merrill-Palmer Quarterly, 21, 205–226.

[5] Bruner J. 1975. The ontogenesis of speech acts. *Journal of Child Language,2*, 1–19

[6] Masur, E. F. (1983). Gestural development, dual-directional signaling, and the transition to *words. Journal of Psycho- linguistic Research, 12*, 93–109.

[7] Acredolo, L., & Goodwyn, S. (1988). Symbolic gesturing in normal infants. *Child Development, 59*, 450–466.
[8] Iverson, J., Caprici, O., & Caselli, M. (1994). From communication to language in two modalities. *Cognitive Development, 9*,23–43.
[9] Nelson KE. (1974). Concept, word, and sentence: interrelations in acquisition and development. *Psychological Review, 8*, 267–285.
[10] Bloom L. 1973. *One Word at a Time*. The Haugue: Mouton.
[11] Wetherby, A., Cain, D. H., Yonclas, D. G., & Walker, V. G. (1988). Analysis of intentional communication of normal children from the prelinguistic to the multiword stage. *Journal of Speech and Hearing Research, 31*, 240–252.
[12] Carpenter, M., Nagell, K., &Tomasello, M. (1998). Social cognition, joint attention, and communicative competence from 9 to 15 months of age. *Monographs of the Society for Research in Child Development, Serial, 255, 63(4).*
[13] Zinober, B., &Martlew, M. (1985). Developmental changes in four types of gesture in relation to acts and vocalizations from ten to twenty-one months. *British Journal of Developmental Psychology, 3,* 293–306.
[14] Crais, E., Douglas, D. D., &Campbel, C. C. (2004). The Intersection of the Development of Gestures and Intentionality. *Journal of Speech, Language, and Hearing Research, 47,* 678–694.
[15] Bigelow, A. E. (2003). The development of joint attention in blind infants. *Development and Psychopathology, 15(2),* 259-275.
[16] Mundy, P., &Jarrold, W. (2010). Infant joint attention, neural networks and social cognition. Neural networks: *Journal of the International Neural Network Society, 23(8-9*),985.
[17] Reinbartsen, D. B. (2000). Preverbal communicative competence: An essential step in the lives of infants with severe physical impairment. *Infants & Young Children, 13(1),* 49-59.
[18] Mundy, P., Willoughby, J. (1998). *Nonverbal communication, affect, and social emotional development*. In A.M. Wetherby, S.F. Warren & J. Reichle (Eds.), Transitions in prelinguistic communication: Preintentional to intentional and presymbolic to symbolic (Baltimore: Paul H. Brookes, 1990) 111-133.
[19] Beuker, K. T., Rommelse, N. N. J., Donders, R., &Buitelaar, J. K. (2013). Development of early communication skills in the first two years of life. *Infant Behavior and Development, 36*, 71-83
[20] Mundy, P., & Newell, L. (2007). Attention, joint attention, and social cognition. *Current Directions in Psychological Science, 16(5),* 269–274.
[21] Mundy, P., Sigman, M., &Kasari, C. (1990). A longitudinal study of joint attention and language development in autistic children. *Journal of Autism and Developmental Disorders, 20(1)*,115–28.
[22] Thal, D., & Tobias, S. (1994). Relationships between Language and Gesture in Normally Developing and Late Talking Toddlers. *Journal of Speech and Hearing Research, 37*, 157-170
[23] Bates, E., Bretherton, I., Shore, C., &McNew, S. (1983). *Names, gestures and objects: Symbolization in infancy and aphasia*. In K. Nelson (Ed.), Children's language,.(Hillsdale, NJ: Erlbaum, 1993) 4, 59-123
[24] Brownell, C. (1988). Combinatorial skills: Converging developments over the second year. *Child Development, 59*,675-685.
[25] Fenson, L., & Ramsay, D. (1981). Effects of modeling action sequences on the play of twelve-, fifteen-, and nineteen-month-old context in early lexical development. *Journal of Child Language, 8*, 565-582.
[26] McCune-Nicollch, L. (1981). Toward symbolic functioning: Struc- ture of early pretend games and potential parallels with language. *Child Development, 52*, 785-797.
[27] McCune-Nicollch, L., &Bruskin, C. (1982). *Combinatorial competency in play and language*. In D. Pepler& K. Rubin (Eds.), The play of children, Current theory and research(New York: Karger, 1982) 30-45
[28] Shore, C. (1986). Combinatorial play: Conceptual development and early multiword speech. *Developmental Psychology, 22*,184-190.
[29] Fenson, L., Dale, P., Reznick, S., Thal, D., Bates, E., Hartung, J., et al. (1993). *The MacArthur Communicative Development Inventories: User's guide and technical manual*. San Diego, CA: Singular.
[30] Wetherby A., &Prizant, B. (1993). *Communication and Symbolic Behavior Scales*. Chicago: Riverside.
[31] Swapna, N., Jayaram, G., Prema, K. S., &Geetha, Y. G. (2010). *Checklists for preschool children with communication disorders (0-6years).* All India Institute of Speech and Hearing: Mysore
[32] Rowland, C. (1990, 1996, 2004*). Communication Matrix*. Unpublished manuscript. Portland, OR: Oregon Health & Science University
[33] Rowland, C. & Fried-Oken, M. (2010) Communication Matrix: A clinical and research assessment tool targeting children with severe communication disorders. *Journal of Pediatric Rehabilitation Medicine, 3,* 319-329.
[34] Petrovich-Bartell, N., Cowan, N., & Morse, P. (1982). Mothers' perceptions of infant distress vocalizations. *Journal of Speech and Hearing Research, 25*, 371-376.

[35] Mundy, P., Delgado, C., Block, J., Venezia, M., Hogan, A. & Seibert, H. (2003*). A manual for the abridged Early Social Communication Scales (ESCS).* Coral Gables, FL: University of Miami, Department of Psychology.
[36] Mullen, E. (1995). *Mullen Scales of Early Learning*: AGS Edition. Circle Pines, MN: AGS.
[37] Zimmerman, I., Steiner, V., & Evatt Pond, R. (2003). *Preschool Language Scale*, (Fourth Edition. San Antonio, TX: The Psychological Corporation, 2003).
[38] Christensen, K. A. (2014). *Assessing Intentional Communication in Typically Developing Infants Using the Communication Complexity Scale*. (Unpublished master's thesis). University of Washington, Washington.
[39] Brady, N. C., Thiemann-Bourque, K., Fleming, K., & Matthews, K. (2013). Predicting language outcomes for children learning augmentative and alternative communication: child and environmental factors. *Journal of Speech, Language, and Hearing Research, 56(5),* 1595–612. http://doi.org/10.1044/1092-4388(2013/12-0102)
[40] Vandereet, J., Maes, B., Lembrechts, D., & Zink, I. (2010). Eliciting proto-imperatives and proto-declaratives in children with intellectual disabilities. *Journal of Applied Research in Intellectual Disabilities, 23,*154–166.
[41] Werner, H., & Kaplan, B. (1963). *Symbol formation*. (New York: Wiley, 1963))
[42] Bzoch, K., & League, R., (1971). *The receptive expressive emergent language scale*. Austin, Tx: Pro-Ed.
[43] Sloetjes, H., &Wittenburg, P. (2008). *Annotation by category-ELAN and ISO DCR*. In Proceedings of the 6thInternattional Conference on Language Resources and Evaluation (LREC 2008).
[44] Venkatesan S. (2004). *Toy kit for kids with developmental disabilities: User manual*. Mysore: All India Institute of Speech and Hearing.
[45] Goldin-Meadow, S., Goodrich, W., Sauer, E., & Iverson, J. (2007). Young children use their hands to tell their mothers what to say. *Developmental Science, 10(6),* 778–85. http://doi.org/10.1111/j.1467-7687.2007.00636.x