

**EFFICACY OF ENHANCED COLOUR CODED
ORTHOGRAPHIC SYMBOLS AS A SYMBOL SET IN
AUGMENTATIVE SYSTEMS FOR CP**

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DEDICATED

TO

MY LIFE PARTNER

FDR HIS LOVE, UNDERSTANDING
TOLERANCE AND CONSTANT ENCOURAGEMENT
WHICH CONTRIBUTED SIGNIFICANTLY TO
MY EDUCATION

CERTIFICATE

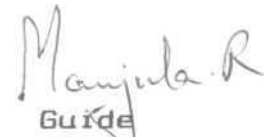
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*EFFICACY OF ENHANCED COLOUR CODED ORTHOGRAPHIC SYMBOLS AS A
SYMBOL SET IN AUGMENTATIVE SYSTEMS FOR CP* is the bonafide
work in part fulfilment for the degree of Master of Science
(Speech and Hearing), of the student with Register No.M9209.


Director,

All India Institute of
Speech and Hearing
Mysore 570 006.

CERTIFICATE

This is to certify that this dissertation entitled *EFFICACY OF ENHANCED COLOUR CODED ORTHOGRAPHIC SYMBOLS AS A SYMBOL SET IN AUGMENTATIVE SYSTEMS FOR CP* has been prepared under my supervision and guidance.



Guide

Mrs. Manjula, R

Lecturer

Dept. of Speech Pathology
All India Institute of
Speech and Hearing
Mysore 570 006.

DECLARATION

This dissertation entitled *EFFICACY OF ENHANCED COLOUR CODED ORTHOGRAPHIC SYMBOLS AS A SYMBOL SET IN AUGMENTATIVE SYSTEMS FOR CP* is the result of my own study under the guidance of Mrs. Manjula, R., Lecturer, Department of Speech Pathology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier at any University for any other Diploma or Degree.

Mysore-6

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LIST OF CONTENTS

	Page No.
1. Introduction	1 - 4
2. Review of Literature	5 - 23
3. Methodology	24 - 33
4. Results and Discussion	34 - 41
5. Summary and Conclusion	42 - 45
6. Bibliography	46 - 51
Appendix-A	
Appendix-B	
Appendix-C	

INTRODUCTION

*"Language is like shot silk: So much depends
on the angle at which it is held".*

John Fowles.

It is well known that human beings like to live in groups. There is a strong need for all of us to interact socially. Human interaction is characterized by symbolic communication i.e. speech. Human interaction also occurs despite the absence of spoken language. For many individuals with severe intellectual disabilities augmentative and alternative communication (AAC) represents a viable route for the establishment of communication skills (Ronski and Sevcik (1988). During the past two decades AAC systems have become an integral component of communication intervention programs for persons with severe cognitive disabilities (Ronski and Sevcik (1988).

The empirical evidence demonstrates that nonspeaking persons with severe cognitive disabilities can successfully acquire the use of AAC systems to replace the spoken language of communication (Silverman, 1977; Reich, 1978; Ronski and Sevcik, 1988). One persistent issue in the literature on AAC systems has been on the discussion of the extent to which features of the symbols themselves may effect their learning and use.

The level of arbitrariness of different symbols i.e. the degree to which a symbol does or does not physically resemble its referent or meaning has consistently been judged to be an important factor in the choice of a symbol set for individuals with severe intellectual disabilities (Musselwhite, 1982; Ronski, Lloyd and Sevcik, 1988).

The symbol and its relationship or resemblance with the referent (iconicity) has remained an area of interest while discussing the usefulness of different symbol sets in CP individuals too. Iconic signs have been found to facilitate vocabulary learning in persons with mental retardation (Goossens, 1983; Griffith and Robinson, 1980; Reichle, William and Ryan, 1981).

Knudson (1980) found that iconic signs that visually represent the function of the referent or action patterns evoked by the referent, were easier to learn than signs that visually represented the static features of the referent. Hurlbut, Iwata and Green (1982) suggested that iconic line drawings were acquired more rapidly, maintained longer and generalized more frequently than Bliss symbols in normal children; (Mizuko 1987, Musselwhite and Russello, 1984). The results of all these studies suggest that iconicity facilitates the learning of graphic symbols. Logographic systems have been used to promote language among variety of clinical population. Bliss symbolics communication Institute

states that enhanced symbols helps in guessing the referent and also provides additional cues. But there are very limited studies which evaluate the efficacy of enhanced orthography symbols. Studies carried out by Clark (1981), Ecklund and Reichle (1987), Mizuko and Reichle (1989), Raghavendra and Fristoe (1990) established only the importance of iconicity over the different symbol sets like Rebuses, Bliss symbols etc. The research work on traditional orthography is very much limited in India. Shilashree (1992) evaluated the efficacy of enhanced symbols among cerebral palsied population of on different schooling level. The subjects were asked to compare the enhanced, emphasized and unemphasized orthographic symbols with the referent. She found that enhanced symbols were identified and matched with the referent more easily when compared to emphasized and unemphasized symbols. Improved performance was also seen from the preschool level to 4th grade level.

Based on the previous study the present study tries to find the efficacy of variation of enhanced symbols in cerebral palsied population. This is done because of the following reason.

The survey conducted by Balaraju (1993) on the "Current status of AAC" in India reveals that traditional orthography is not widely used as an AAC in India (In Karnataka only two rehabilitation centres - are using traditional orthography as an AAC).

In order to investigate the feasibility of traditional orthography as a symbol set for AAC system and to highlight the effectiveness of the enhanced symbols.

In this study 12 written words in Kannada were enhanced in two ways: 1) Enhanced symbols -100% of a syllable of the word was used to pictorially represent the referent. 2) Semi enhanced symbols: 50% of a syllable of the word was utilized to pictorially represent the referent.

The semi enhanced and enhanced symbols were drawn in black and white and were also coloured to correspond to their natural colour (the colour acting as a further enhanced cue). This study aimed at evaluating the role of the enhanced (black and white and colour) and semi enhanced (black and white and colour) symbols the cerebral palsied population.

REVIEW OF LITERATURE

Communication serves as the basis for social relationships of all kinds. This is also true in human communication. Human beings communicate in two ways. The more obvious method is through the spoken speech, that is verbal. However, we can also communicate without speaking through many nonverbal modes. This includes the use of gestures, signs and symbol sets.

Speech however, constitutes the primary mode of communication in human beings. Those who are unable to speak or cannot make themselves understood adequately are also handicapped in their ability to communicate personal attitudes and traits. Thus, they are also unable to establish satisfactory social relations. There are a number of children and adults, who are unable to use speech for communication purposes. In many cases, speech therapy offers a solution to such individuals. But there are some cases, where speech therapy has limited results. Such individuals depend on nonverbal communication.

Nonverbal communication implies language communicated by means other than speech organs (Ronski and Sevcik, 1991). The non-verbal communication is also termed as "Augmentative and alternative communication" (Bennett, 1987). This may be

defined as "communication using modes of expression or comprehension other than speech by which language is facilitated to any individual. These non-speech modes include techniques to encode messages and then transmit them without verbally producing them (Bridgeman, 1927; Silverman, 1980).

AAC system:

AAC system are communication system used in addition to or instead of speech. "Augmentation" means facilitation. Thus AAC refers to enhance or augment communication (Bennett, 1987).

Non-speech communication modes can be defined operationally as "procedure for encoding and transmitting messages without their being directly encoded into phonemes by the vocal tract. Thus, any approach to encoding and transmitting messages that does not require a person to directly produce speech sounds would be classifiable by this definition as a non-speech communication mode (Bridgeman, 1927).

According to Whitney (1972) "AAC refers to any communication approach designed to support, enhance or

augment the communication of individuals identified as non-speaking".

AAC systems for communication disorders:

There is a diverse group of people for whom an AAC system will facilitate their communication (Ronski and Sevcik, 1988). It includes individuals whose communication deficits are congenital or acquired as a result of neuromotor deficits. The poor prognosis for verbal communication could result from any of the several conditions including severe mental retardation, childhood autism, childhood aphasia, cerebral palsy, apraxia of speech, laryngectomy and severe hard of hearing. During the past few years there has been considerable work on developing AAC systems for such persons (Guess, Homer, 1978).

The usefulness of AAC systems have been documented with various clinical groups (Vanderheiden, 1976; Archer, 1977; Fristoe and Lloyd, 1980; Mizuko and Reichle, 1989; Sevcik and Ronski and Wilkinson, 1991; Clark, 1992; Shailashree, 1992).

AAC symbol sets have been classified as either aided or unaided (Lloyd and Fuller, 1986; Vanderheiden and Lloyd, 1986; Blau, 1987). Unaided symbol sets and systems include

manual signs or gesture Eg. AMESLAN, AMER-IND, while aided systems generally utilize visual graphic symbols. Traditionally aided systems are used with individuals with severe physical disabilities. The unaided systems are used with the children who exhibit other primary disabling conditions like mental retardation (Vanderheiden, Brown, MacKanzie, Reinen and Scheibel, 1975).

Aided system are discriminated based on the symbol systems as non-electronics gestural assisted communication systems, and electronic gestural assisted communication system). The aided communication system can also be divided based on the display, symbol sets and means of indicating. The indications may be in terms of electronic device or non-electronic device (Silverman, 1980).

The symbols used in the aided modes are different from speech or manual signs in that, the symbol which have spatial representation on the display may be selected by the user using an associative memory. This in turn may depend on the arbitrariness of the symbols as compared to the referents (Rombski and Sevcik, 1991).

Symbol systems in aided AAC system:

A symbol system is a set of sensory (visual, auditory or tactile) images or signs that suggest or stand for something else by reason of relationship. Symbols are physical components that represent feature of the referent in the environment (Bennett, 1987).

According to Wilkinson and Ronski (1988) symbols play dual roles in early cognitive and linguistic development in a child. They are the medium by which nonspeaking persons communicate and they provide an inference about how these individuals perceive and construct their world.

Representation is the process by which individuals depict their experience of the world (Sevcik, Ronski and Wilkinson, 1991). Language is one of the most sophisticated types of representation and symbolic in nature. During the course of development of the child, representation may be achieved through nonsymbolic means as well. Bruner (1968) has outlined a three stage model in order to characterize a child's representational development. The first stage is an enactive stage - a level of action where several activities experienced by the child are organized. The second stage is an iconic representation which is imaginary - when a child

Visually associated symbols:

1. Bliss Symbols: This system was developed by Charles K Bliss (1965). This system is used with non-verbal children, physically handicapped (Kates and McNaughton, 1975; Silverman et al. 1978), Mild to severe mentally retarded (Harris and Vanderheiden), deaf (Goddard, 1977) and adult aphasics (Saya, 1979).

2. Rebuses: This was developed by Clark, Davis and Woodcock (1974). This system contain line drawings which visually represents objects, actions and attributes. Rebuses are used with wide variety of population - the hearing-impaired, mentally handicapped children (Clark and Davis, 1968, 1969). Some carefully selected symbols can be used with severely speech impaired adults (Bennett, 1987). Rebuses can be displayed on communication boards or can be used along with traditional orthography.

Pictogram ideogram communication (PICS):

This was developed by Carlson and James (1980). PICS is a graphical symbol system which are semantically based and followed logical principles. PICS may be used with non-speaking children or adults with language disorders.

Picture/photographs and line drawings:

A wide variety of materials may be used in this category. Pictures may be clipped from magazines, newspapers or books. They are generally used with cerebral palsied children, dyslexics, severe mentally retarded.

Coded symbolic language:

These represent a spoken or written language.

1. Braille - This system was invented by Louis Braille in 1824. This system is mainly used by the blind. It is a tactile symbolic system which is based on traditional orthography. These are formed by raised dot patterns.
2. Morse code: This encodes letters and digits through a series of dots and dashes. This system requires good finger control.
3. Traditional orthography: This refers to the written alphabet representing a language. The letter of a written alphabet of a language can be arranged and used in various ways on communication boards. The alphabet may either be taught in simple or in the form of simpler functional words associated with this respective pictures.

Pictorial and orthographic symbol representation on a display simultaneously increases the association between the

referent and orthographic symbol. Using orthography word boards may be made. Words which are more meaningful, functional and easy for the child are represented on the board initially. Once the association between picture (referent) and the symbol (gloss) is formed, the stimuli or the picture may be faded off and only the orthographic responses may be established in the child.

Traditional orthography enhances the communication between the child and observers (Silverman, 1980). It is necessary to have good visual discrimination skills, since small differences between letters need to be noted also a high level of cognitive development for encoding of words. A knowledge of language structure and spelling skills are necessary for formulating words and sentences.

Review on the use of symbol system with the speech and language impaired:

Human interaction is characterized by symbolic communication. During the last two to three decades there has been an increased use of symbol systems with the non-verbal children. Various studies have tried to investigate the efficacy of various systems on the nonverbal children (Porter, Brick and Hagen, 1973; Archer, 1977; Clark, 1981; Luftig Bersani, 1985; Sevcik, Ronski and Wilkinson, 1991).

Symbols as a vehicle for expression can be represented in a continuum. At one end of the continuum, completely arbitrary symbols are present. These are printed or spoken words which bear no physical relationship to the referents they represent. At the other end are the iconic symbols that look like what they actually represent (Bloomberg, Karlan and Lloyd, 1990; Clark, 1981; Mirend and Locke, 1989).

Iconicity has been defined by many authors, based on different points of view. Iconicity was defined and referred to as an intrinsic resemblance between a sign and its referent (Wescott, 1971). According to the linguistic definition iconicity should be evident even to persons unfamiliar with the language (Pierce, 1971).

Mizuki (1987), Mizuki and Reichle (1989) have defined iconicity on the physical basis as the visual resemblance of the elements of sign or symbol to the referent or the degree to which a sign is defined by or resembles its referent.

Luftig and Bersani (1985) defined iconicity on perceptual basis as the apparent relationship between a symbol and its meaning (gloss) to learners. There are many evidences which indicate that the symbols which are iconic

are learnt more easily than non-iconic (Brown, 1977: Griffith and Robinson, 1980).

Iconicity is further differentiated by the variables of transparency, translucency and opaqueness. These terms define the degree to which each symbol may be guessed. Transparent symbols are those that are easily guessable even in the absence of the referent or cues (Mizuko and Reichel, 1989). These symbols are typically concrete and pictographic, containing physical resemblances to the referent item. Eg. Bliss symbols.

Translucent symbols refers to those ideographic symbols whose meaning cannot be easily guessable in the absence of the referent, but a relationship between a symbol and referent is generally perceived once the referent is known (Luftig and Bersani, 1985; Mizuki, 1987; Mizuki and Reichle, 1989). Bloomberg (1990) defines translucency as "those symbols or signs which may be guessed after conceptual or contextual cues are given".

Opque symbols are non-guessable. Here the relationship between the symbol and its referent is viewed as arbitrary in nature. They are not pictographic, concrete or ideographic referents. Iconicity has been the main issue of discussion

in the past few years. various studies have tried to find the iconicity of different symbols in different population. Studies in this area can be divided into two groups ie. those studies which support the role of iconicity in acquisition of sign and the other group which points to the limited role of iconicity in the acquisition of sign or symbol system.

According to Griffith, Robinson and Penagos (1981) iconicity is not the sole criteria in the facilitation of sign language. There are other criterias also. This view point was supported by studies conducted by Hormann, 1975; Bellugi and Tulenry, 1981). As against the above view point, other studies have supported the role of iconicity (Sevcik, Ronski and Pate, 1988; Fuller, 1989; Gamble, 1990). Their studies have shown that iconic signs may be learned more easily, quickly and retained longer than noniconic symbols.

Sevcik, Ronski and Pate (1988) found that iconicity served as an important factor if a disabled individual was learning to associate an already known spoken word with a symbol. But iconicity did not become the primary issue, if the word was not in the receptive vocabulary of the child. Iconicity of the symbol also increases the motivation by the apparent ease with which signs were learnt and remembered and by the effectiveness of these signs in communicating with others.

Fuller (1987) conducted a study with adult and young subjects (4.5 to 5.5 years of age), in which he varied the dimensions of Bliss symbol translucency and complexity in a paired associate task. He found that the symbols that were highly translucent were learned most often.

Liberth and Gamble (1990) pointed out that transparency was an important feature that facilitated the learning of manual sign. This study on sign-naive college students indicated that though both transparent and nontransparent signs were retained, over a long period of time, the number of non-transparent sign retention decreased.

Few studies tried to compare the various symbol sets for their transparency symbol sets for their transparency. All these studies concluded that pictographic symbols were highly transparent as compared to ideographic symbols (Bliss or Carrier symbols) and these were in turn easier when compared to traditional orthography (Dixon, 1981; Hurlbut, Iwata and Green, 1982; Goossens, 1983/1984; Sevcik and Ronski, 1986; Mirenda and Locke, 1989 and Mizuko and Reichle, 1989).

Archer (1977) compared the ease of learning of words and Bliss symbols by cerebral palsied children with poor oral communication. According to him, Bliss symbols provides a

means of grammatically adequate communication as against the use of only pictures or word board.

Clark (1981) compared the learning of words using traditional orthography and logographic symbols (Rebuses, Bliss and Carrier). The results indicated that the symbols which were iconic were learnt faster and logographic symbols were easier compared to orthographic symbols. Among the three logographic symbols Rebus and Bliss were easier compared to carrier, and Rebus was learnt faster than Bliss symbols.

Musselwhite and Ruscello (1984) compared the transparency of Rebus Ricsyms and Bliss symbols on the normal children. They compared the different age groups (ie.3 years to 21 years) on the task of matching the symbol to spoken word. The results supported the view of Clark (1981). Picsyms and Rebuses were easier compared to the bliss symbols.

Luftig and Bersani (1985) investigated the role of translucency in learning the blisssymbols on nonhandicapped College students. He found that highly translucent symbols were learned faster compared to low translucent symbols. The same authors tried to find the efficacy of blisssymbols over

orthography. They found that blissymbols were easy to learn and faster compared to traditional orthography.

Ecklund and Reichle (1987) compared the learnability of Rebus and bliss symbols on normal children. Their results supported the view point of Clark (1981). Bliss symbols were difficult to learn compared to rebus symbols. In another study Mizuko (1987) assessed the transparency and learnability of picture communication symbols; picsyms and bliss symbols. He studied the normal children of 2.3 to 3.8 years. Results indicated that PCS and picsyms were easier compared to bliss symbols and PCS was very iconic compared to picsyms. A similar study by Mizuko and Reichle (1989) on intellectually handicapped adults showed that Bliss symbols were relatively difficult to learn compared to picsyms and picture communication system.

Pat Mirenda and Locke (1989) investigated the 11 different symbol systems and real objects on intellectually disabled children. Their results showed that the real objects were more readily organized than any of the symbol sets. Secondly the bliss symbols and written words were more difficult than any other sets. Their symbol transparency studies used both handicapped and non-handicapped children.

Fuller (1992) studied the effect of translucency and complexity of the symbols in normal adults and preschool children with normal cognitive ability. The results revealed that adults and children learned more high translucent symbols compared to lower translucent symbols. Complexity was not a factor in the learning of symbols by the adults. But for preschool children complexity of the symbol facilitated during learning, when there was little resemblance between symbol and referent.

There is very limited evidence to assess the iconicity of different representational symbol systems across different word categories.

Bloomberg (1984) compared the translucency ratings of nouns and verbs across Bliss symbols, picsyms and PCS, PIC and Rebus. She found that rebus was the most translucent system across the three word classes represented. Mizuki (1987) investigated the transparency and acquisition of different symbol systems ie. Bliss symbols, picture communication system and picsyms, across nouns, verbs and descriptors. PCS transparency scores were the highest across all three grammatical classes compared to Picsyms and Bliss symbols. Secondly the symbols which were iconic were more easily recalled. This study supported the study by Goossens (1983) and Hurlbut's (1983 b).

Bloomberg, Karlan and Lloyd (1990) compared the translucency of five different symbols on three parts of speech (noun, verb and modifies). Rebus symbol and picture communication system were the most translucent overall for all word classes. PIC and picsyms were equivalent in the translucency and bliss symbols were the most difficult.

Most of these studies indicated that iconicity of the symbols played an important role in the learning of various symbol sets. Iconicity facilitated the learning of graphic symbols. The reason for the consistently lower transparency found for Bliss symbols could be due to composite factors that seem to be related to the underlying logic of symbol design.

The implication of all these studies is on the selection of the symbol set to teach the handicapped children based on their cognition physical condition and motivation. The clinician should consider the ease of acquisition of learning the symbol set, while selecting the teaching mode to the child.

Traditional orthography:

Traditional orthography is coded symbolic language. It is an aided symbol system. In English the 26 letters of the

Logographic symbols were found to be easier compared to orthographic symbols.

Luftig and Bersani (1985) compared the efficacy of Bliss symbols over orthography for physically disabled population. They found that bliss symbols were easy to learn compared to traditional orthography. They also highlighted the reasons for the ease of acquisition of bliss symbols over traditional orthography ie. of motivation of subjects and transparency level of symbols.

The other studies carried out by Ecklund and Reichle, 1987; Mizuki, 1987; Mizuki and Reichle, 1989; Pat Mrenda and Locke 1989; compared the different symbols like rebuses, Bliss, picsyms and concluded the symbols which were iconic were learned faster and retained longer.

Shailashree (1992) evaluated the efficacy of iconic symbols over noniconic symbols in Kannada language with 30 cerebral palsied children. The traditional orthography symbols in Kannada language were enhanced and compared with emphasized and unemphasized symbols. 15 Kannada words were selected and enhanced. The same words were also modified as emphasized and unemphasized symbols. They were administered to 30 cerebral palsied subjects whose

chronological age ranged from 3 to 20 years. These children were divided into groups based on the education and the exposure of the children to orthography. The subjects were asked to compare the enhanced, unemphasized symbol and emphasized symbol with the referent. The results indicated that enhanced symbols were identified better followed by emphasized and unemphasized symbols.

In this study an attempt is made to evaluate the effect of further variation of enhanced orthography symbols in cerebral palsied population. The 12 traditional orthography symbols were modified into enhanced symbols and semienhanced symbols. In enhanced symbols, a syllable of the word was picturized in terms of 100% to represent the referent. In semienhanced symbols, 50% of the syllable of a word picturized to represent the referent. These two sets were drawn in black and white and was also coloured to correspond to their natural colour. This was planned in order to (i) evaluate the efficacy of enhanced symbols over semienhanced symbols, (ii) to find whether the performance varied between colour coded symbols and black and white symbols? (iii) if the difference existed in the performance between the two symbol sets, at which level does it reach to plaetou? (iv) to study the performance of the subjects in across different age groups.

METHODOLOGY

The study aimed at -

1. Comparing the efficacy of enhanced and semienhanced orthographic symbols in cerebral palsied population.
2. Comparing the efficiency of colour coding and black and white effects in the enhanced and semienhanced symbols.
3. To analyse the performance of groups of cerebral palsied children at various schooling levels and to look for developmental pattern of performance.

Subjects:

Fifty five cerebral palsied children ranging from 3 years to 24 years were selected as subjects for this study. Of these 46 were spastics and 9 were athetoids with mild to severe degree of involvement. The design of this study was based on Shailashree's (1992)* study. The children were grouped based on the exposure to orthography as preschool group, transition group I grade group and IV grade group. (Refer Table-1 for the classification of subjects).

*Shailashree evaluated 30 CP children's performance on enhanced, unemphasized and emphasized orthographic symbols. She graded the children based on the exposure to orthography. Of the 3 types of orthographic symbols, the enhanced symbols were identified better and compared with the referent more accurately than the other. The performance was also seen to increase with the increase in schooling level.

	Preschool	Transition	1 grade	IV grade
No.of children	11	14	14	16
Exposure to orthography in Kannada	No	Exposed to only few letters	Yes, but not able to read the written script	Able to read the written script
Exposed to traditional orthography	No	No	No	No

Table-1: The classification of subjects.

Criteria for selection of the subjects:

The children selected as subjects for this study were screened and matched for the following variables. The variables controlled were as follows:

1. The children who had average, above average or borderline intelligence were considered.
2. Children with sensory deficits without any correction were not considered.
3. Only children with fairly adequate visual perception were considered.

4. Only those children who had all the 12 vocabulary items of the test in their receptive vocabulary were selected. Those who did not have these items in their receptive vocabulary were familiarized with the referent pictures.
5. The selected subjects had adequate comprehension and could comprehend the instructions given to him/her during the training as well as testing sessions.
6. The children could respond verbally (Yes/No) or nonverbally ie. children expressed the response through eye blinking or finger pointing.



Material:

Fifteen written words in Kannada were selected for the present study. All the fifteen words were written on the separate cards. Of the fifteen cards, seven cards were selected from Shailashree's (1992) study. Care was taken to see that the selected words were nouns, picturizable and were present in the receptive vocabulary of the children. Then the written words were subjected into two types of modifications -

- (i) Enhanced and
- (ii) Semi enhanced.

- (i) Enhanced symbols: In each of the selected written words one of the syllable was subjected to enhancement. That is, this syllable was enhanced in such a manner that it resembled the referent picture by 100%.



For example:



Referent	Vocabulary	Meaning in English	IPA	Enhanced symbol
	ಎಲೆ	leaf	ele	

Here the syllable 'ಎ' of the written word 'ಎಲೆ' was enhanced to resemble the referent picture of a leaf. In this manner all the other 15 words were enhanced.

- (ii) Semi enhanced: In each of the selected written word, only the selected syllable was partially subjected to enhancement. That is this syllable was partially enhanced by 50% in such a manner that it resembled the referent picture.

For Example:

Referent	Vocabulary	Meaning in English	IPA	Semienhanced symbol
	ಎಲೆ	leaf	ele	

Here the syllable  of the written word  was partially enhanced to resemble the referent picture of a leaf. In this manner all the 15 symbols were semi enhanced.

(iii) The syllable of the 15 selected words which were subjected to semi enhancement and enhancement were drawn in two different colour codes:

- a) black and white
- b) colour - Here the enhanced and semi enhanced syllables were drawn in natural colour resembling the referent picture. Thus the test material consisted of

Enhanced black and white symbol	-	15
Enhanced coloured symbols	-	15
Semi enhanced black and white symbols	-	15
Semi enhanced coloured symbols	-	15
	Total	60

The 60 stimulus words were then written/drawn on thick white card measuring 5.5x7 inches. They were then constituted 60 test words which were administered on the selected groups of cerebral palsied children in this study.

To ensure that the symbols which were enhanced/semi enhanced actually resembled the referent, 10 Kannada

speaking speech pathologists who could read and write Kannada language were asked to rate the 60 symbols for their iconicity. The judgement was made with respect to the referent picture and they were also requested to judge whether symbols were enhanced or semi-enhanced as defined in this study. A 5 point rating scale was used and the speech pathologists were requested to rate the iconicity of the symbols. The ratings were as follows:

Rating	Degree of iconicity
1	Symbols are highly iconic
2	Symbols are very iconic
3	Symbols are fairly iconic
4	Symbols are less iconic
5	Symbols have least iconicity

The test formant which was given to speech pathologists for rating was as follows:

Sym- bois	Black & white	Enhan- ced	Semi enhan- ced	coloured	Enhan ced	Semi enhan- ced	Re ma rks
--------------	------------------	---------------	-----------------------	----------	--------------	-----------------------	-----------------

1	1	2	3	4	5	Yes	No	Yes	No	1	2	3	4	5	Yes	No
---	---	---	---	---	---	-----	----	-----	----	---	---	---	---	---	-----	----

2

3

60

All the symbols which obtained a rating of 1, 2 and 3 were accepted as being iconic and those symbols rated as 4 and 5 were modified until their transparency improved. 12 symbols out of 60 were rejected ie three written words could not be subjected to modification. Thus 48 symbols were finally retained as the test cards.

Response sheet:

A response sheet was constructed which consisted of the list of 48 symbols. The 48 symbols were arranged in a random order. Refer appendix-A for the response sheet.

The scores obtained by the subjects and mode of expression by the subjects were recorded on the response sheet. If the child was not able to respond spontaneously cues were provided to the child. The child was rated accordingly depending on the cues that were provided to the child. The ratings were as follows:

	Score
Spontaneous expression	4
Responses with self correction and repeated instruction	3
Responses after providing auditory cue	2
Response after the visual tracing cue provided by the examiner to show the resemblance between the referent and the symbol.	1

The testing session was carried out in three phases: (1) screening phase (2) training phase (3) testing phase.

Screening phase: Here the selected symbols were screened for the following abilities:

- 1) Visual matching ability - Two sets of referent pictures were taken and the subjects were screened for their ability to match the pair of referent pictures.
- 2) Matching the referent picture with unenhanced written symbol of the picture.

The subjects who had the ability to match the unenhanced symbols with the referents were selected for the study.

Procedure:

The testing was carried out in a well illuminated room with minimal distractions. The children were tested individually. The child was seated comfortably on a chair with a table in front of him. The referent picture cards were laid on the table and the child was asked to scan all the referent pictures before administration of the test. The child was instructed to point to the referent picture

which resembled the stimulus card, as the examiner provided the stimulus cards.

Training session:

The child was explained the visual resemblance between the written word symbol and the referent picture. A relationship between each of the four cards in a set was shown. Description of all the 12 vocabulary items was given. If a particular vocabulary item was found to be missing in the receptive vocabulary of the child, it was familiarized and described to the child. Each training session lasted for approximately 20 minutes.

Testing session:

Test was administered the consecutive day after the training session. In this, referent picture cards were laid on the table. The child was made to scan all the pictures before the administration of the test. The experimenter provided the child with various symbols in the order, listed in the response sheet. Child had to point to the corresponding referent picture and produce the vocabulary word, verbally or non-verbally. If the child could not produce any response, spontaneously or with self correction, several cues as listed earlier were provided.

Each child was given positive verbal reinforcement after the training as well as testing session. Reliability was also checked for five of the subjects in which the scores were did not differ. The subjects scures were recorded on the response sheet. The raw scores of the group of subjects were then statistically analysed and discussed.

RESULTS AND DISCUSSION

The results are discussed under the following headings.

I. Performance of the four groups (preschool, transition, I grade and IV grade) of cerebral palsied subjects for the

(1) Enhanced orthographic symbols

a) Black and white enhanced orthographic symbols.

b) Coloured enhanced orthographic symbols

(2) Semienhanced orthographic symbols

a) Black and white enhanced orthographic symbols

b) Coloured enhanced orthographic symbols.

II. Comparison of subjects performance at various grades of schooling (ie. from preschool to IV grade) for the different types of selected symbols.

I. Performance for black and white symbols versus colour coded symbols.

Subjects performance for	Mean	T value
Coloured symbols	96.40	3.24
Black and White symbols	94.88	

Table-1a: Mean scores for coloured and black & white symbols.

From Table 1(a) the mean scores reveal that the performance of all the group of subjects for the coloured symbols was better compared to Black and White symbols. The T value clearly indicates that the two groups significantly differ from each other. The difference was highly significant at 0.01 and 0.05 levels. The colour added as a cue for the enhancement could have improved the iconicity of the symbols and facilitated the learning of symbols.

This finding partially supports the studies by Clark, 1981; Hurlbut, Iwata and Green, 1982; Goosens, 1983; Sevcik and Romski, 1986; Mirenda and Locke, 1989; Mizuki and Shilashree, 1992 in stating that degree of iconicity plays an important role during the process of learning the symbols.

This study supports the Hurlbut, Iwata and Green's (1982) study where they conclude that coloured line drawings were acquired faster compared to noncoloured symbols.

The role of contextual cue is important for the identification of symbols (Romski and Wilkinson, 1991; and Mizuki and Reichle 1989). It is possible that the ease of discrimination (Mineo, 1989; and Goosen, 1983) improves with the addition of colour which in turn improves the learning of symbols. (Romski and Sevcik, 1981) might also

have improved because of the colour cue. As the results reveals that colour coded symbols are identified better than the black and white symbols, the colour coded symbols may be selected more often for use with AAC.

II. Performance for enhanced versus semi enhanced symbols:

The mean score and the T' value were calculated to analyse the subjects performance for enhanced versus semi enhanced symbols.

Table 2(A):

Subject performance for		Mean	T value for Enhanced Vs. Semi enhanced
Enhanced	Black and white	46.09	2.70
	Coloured	46.68	
	Combined	92.77	
Semi enhanced	Black and white	45.62	
	Coloured	46.02	
	Combined	91.64	

Table 2(a) confirms that enhanced symbols are better indentified compared to semi enhanced symbols. The mean score is found to be better for enhanced symbols. The T score indicates that these two groups significantly differ from each other.

Subjects performance for black and white and coloured symbols for enhanced and semienhanced symbols was analysed. The scores were given in Table 2(b).

Enhanced black and white vs. enhanced colour	s
Enhanced black and white vs. semi enhanced black and white	- o
Enhanced black and white vs. semi enhanced colour	- o
Enhanced colour vs. semi enhanced colour	- s
Enhanced colour vs. semi enhanced black and white	- s

The enhanced symbols in the sample were those, where a syllable of the written word of a referent picture was totally enhanced by 100% to resemble the referent picture. The semi enhanced symbols on the other hand, were those where only a part of a syllable of the written word of a referent picture was enhanced partially or by 50% to resemble the referent picture. The 100% enhancement (enhanced) were identified better by the subjects on the whole compared to 50% enhancement (semi enhanced). This indicates that the degree of enhancement and size and portion of enhancement over the syllable are also contributes to the identification of the symbol.

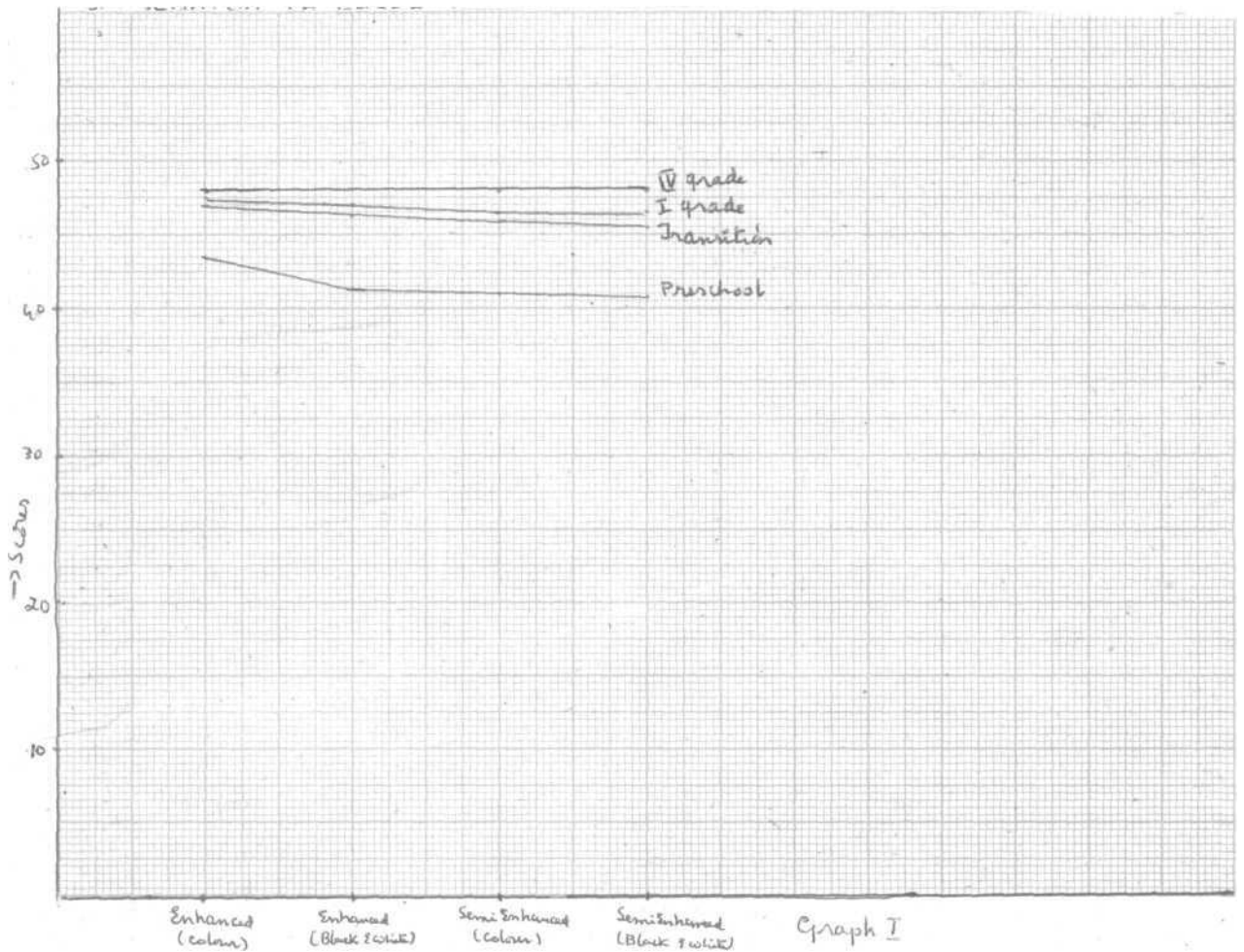
According to Werner and Kaplan (1984) the nature of the symbol helps in the internal fusion between a physical form

and corresponding semantic meaning. In this sample iconicity improved (Hurlbut, McNaughton, Warnick, (1984); Iwata and Green (1982); Goossen (1983); Sevcik and Ronski (1986), Miranda and Locke (1989); Mizuki and Reichle (1984) and Shailashree (1992) in the enhanced compared to semi-enhanced and the colouring factors seem to have also contributed for better identification.

III. Comparison of subjects performance at various grades of Schooling for the different types of symbol sets.

Type of enhancement		Groups			
		Preschool	Transition	I Grade	IV Grade
Enhanced Black & White	Mean	41.72	46.14	47.21	48
	SD	2.21	1.40	0.88	0
Enhanced Colour	Mean	43.72	46.57	47.64	48
	SD	2.41	1.17	0.61	0
Semi enhanced Black & White	Mean	41	45.64	46.78	48
	SD	2.17	2.02	1.14	0
Semi enhanced colour	Mean	41.27	46	46.92	48
	SD	2.19	1.90	1.02	0
Enhanced vs. semi enhanced		2.54	14.8	3.33	0
T scores at each schooling level		Significant at 0.05 not at 0.01	Significant at 0.01	Significant at 0.01	Not significant

The above table indicates the performance of the subjects at various levels of schooling. The mean values, standard deviation and 'T' scores were calculated. The results clearly indicate the increase of score from the preschool level to the IV grade school. The standard deviation of the samples from the mean is great for preschool children compared to the IV grade. The 'T' score was calculated for each group. T scores give the score for enhanced versus semi-enhanced at each level. There was a significant difference at 0.01 and 0.05 level between the enhanced and semi-enhanced at preschool level. But at the transition level the difference exists at 0.01 level for the enhanced versus semi-enhanced symbols. This is graphically



The performance for I grade children for, enhanced versus semienhanced existed at 0.01 level. But the IV grade children performed similarly for all the four symbol sets which indicates that significant difference does not exist between the symbol sets. The mean and standard deviation values clearly shows that as the schooling increases the performance also increases. There is a gradual increase from the preschool to IV grade. The standard deviation scores decreases from preschool to IV school for all the four symbol sets.

To analyse and to compute the significant difference between the subjects performance across different schooling level, New Man Keul's comparison report* was administered. The tabulated scores is shown in Table-3.

	Preschool	Transition	I Grade	IV Grade
Preschool	-	S	S	S
Transition	S	-	S	S
I Grade	S	S	-	S
IV Grade	S	S	S	-

Table-3.

* Newman-Keuls method is a commonly used multiple comparison method which gives the significant difference at 0.0b level. In this test Newman Keul's comparison report was based on the ANOVA test results).

From the above Table-3 it is evident that each group is significantly different from the other. The difference was significant at 0.05 levels.

As Brown (1977) indicates, the iconicity is culture bound, time bound and experience bound, the individual should have the particular semantic concept within their linguistic repertoires which aids during the association of meaning with the symbols.

As the test items were very simple, and were present in the vocabulary of the children the performance was better. This study also agrees with the Fuller's (1987/1988) study concluding that the complexity determines the performance across different age level. He concluded that complexity positively influences the children's symbol learning. But as the age increases the complexity does not play very important role. In the early stage as the complexity plays a positive role, subjects need a contextual cue.

Thus, it is evident from the present study, that the identification of symbols by the subjects improved in the following hierarchical manner: Enhanced coloured symbols, Enhanced black and white symbols, Semi enhanced coloured symbols and Semi enhanced black and white symbols.

SUMMARY AND CONCLUSION

Communication is very essential to human life. But approximately 70% of the cerebral palsied children manifest disturbance in their ability to communicate. Augmentative communication system (AAC) is found to be useful with a majority of cerebral palsied children (Richardson, 1975; Silverman, 1977; Reich, 1978; Ronski, Sevcik and Pate, 1988).

Symbols selected for use in AAC play an important role for nonspeaking persons. They act as the medium by which nonspeaking persons communicate and they provide an inference about how these individuals perceive and construct their words. In the present study certain aspects of traditional orthography as a symbol system for cerebral palsied population was studied.

The effectiveness of different variations of enhanced traditional orthographic symbols in cerebral palsied population was studied. The subjects were classified based on the exposure to orthography into four grades which included preschool, transition, Grade I and Grade IV. While selecting the subjects, care was taken to see that the subjects had no mental retardation and other sensory and perceptual problems.

12 Kannada words were finally selected as the test material. These words were nouns, picturizable and were

familiar to the subjects. Correspondingly 12 two dimensional referent pictures were drawn. This set of 12 words were modified to enhance the symbol quality in two ways. The first set was called as enhanced symbols where a syllable of the word was modified by 100% to resemble its referent. The second modification was called as semi enhanced symbols in which only a part of a syllable of a word or 50% of the syllable was enhanced to pictorially represent the referent. These two sets were drawn in black and white and in colour to match with the natural colour of the referent object. Thus four orthographic symbol sets were obtained as follows:

- 1) Enhance Colour (2) Enhanced Black and white
- 3) Semi enhanced Colour (4) Semi enhanced Black and white.

A total of 48 symbols (12 x 4) were constituted the test material for this study.

The fifty five subjects were selected as subjects for the present study. The study was carried out in 3 phases (1) screening phase (2) training phase and (3) testing phase. The subjects were selected after they were screened for the visual discrimination task. The subjects were trained to match for the 12 referent cards with the 48 test cards in training session. The test was administered on the consecutive day. Here the subjects were asked to identify and match the test card with the respective referent picture.

The subjects responses varied from verbal to non-verbal (eg. pointing to the referent or by eyeblinking).

When the subjects were unable to give the responses, they were provided various cues in the form of auditory and visual cue and responses were weighed on a 5 point scale. The raw scores of subjects were tabulated and analyzed. The results were found to be as follows:-

1. Enhanced symbols play an important role. They were identified better compared to semi enhanced symbols.
2. The varied enhanced symbols ie. enhanced coloured symbols were identified better compared to enhanced black and white symbols. This reveals that, that colouring the symbols acts as a cue and facilitates in the identification of the words.
3. Performance of the subjects varied with respect to schooling. As the schooling level increased the performance also increased. Fourth grade children associated the referent card with the test card easily compared to the preschool children. The results shows that colour contributed as a cue till the first grade which resulted in a gradual increase in the mean score of the subjects. But for the fourth grade, it does not contribute as they were able to associate without the help of the cue.

The results of the study imply that traditional orthography as a symbol set in AAC system has its clinical utility in the cerebral palsied population. Varieties of enhancement of the orthographic symbols (in the form of colour and type) to match their referent picture either partially or totally facilitate the identification of the symbol by the subjects.

Future directions:

1. The design needs to be replicated with other Indian languages and other types of clinical population such as mental retardation and autism, etc.
2. Other varieties of enhancement of the orthographic symbols need to be explored.

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NOTE:

Symbol Representation

- 1 - Enhanced black & white
- 2 - Semi Enhanced black & white
- 3 - Enhanced colour
- 4 - Semi Enhanced colour







<u>Score</u>	<u>Cue</u>
--------------	------------

- | | | |
|---|-----|---|
| a | - 4 | - Spontaneous Response |
| b | - 3 | - Self correction after repeated instructions |
| c | - 2 | - Auditory cue |
| d | - 1 | - Visual tracing cue |
| e | - 0 | - No Response |

APPENDIX - B

	REFERENT	VOCABULARY	IPA	MEANING	ENHANCED	SEMI ENHANCED
1		ಬೆಕ್ಕು	/be'kku/	CAT	ಬೆಕ್ಕು 	ಬೆಕ್ಕು 
2		ಎಲೆ	/ele/	LEAF	ಎಲೆ 	ಎಲೆ 
3		ಇಲಿ	/ili/	RAT	ಇಲಿ 	ಇಲಿ 
4		ದೀಪ	/di:pa/	LIGHT	ದೀಪ 	ದೀಪ 
5		ಬಿಸಣಿಗೆ	/bi:saɳige/	FAN	ಬಿಸಣಿಗೆ 	ಬಿಸಣಿಗೆ 
6		ಚೆಂಡು	/tʃɛndu/	BALL	ಚೆಂಡು 	ಚೆಂಡು 

APPENDIX - B

	REFERENT	VOCABULARY	IPA	MEANING	ENHANCED	SEMI ENHANCED
7		ಗಂಟೆ	/gante/	BELL	ಗಂಟೆ	ಗಂಟೆ
8		ದಾಳಂಬೆ	da:limbe	POMEGRANATE	ದಾಳಂಬೆ	ದಾಳಂಬೆ
9		ಫತ್ತಿ	tʃathri/	UMBRELLA	ಫತ್ತಿ	ಫತ್ತಿ
10		ಚಿಟ್ಟೆ	tʃitte/	BUTTERFLY	ಚಿಟ್ಟೆ	ಚಿಟ್ಟೆ
11		ಸರ	Sara/	CHAIN	ಸರ	ಸರ
12		ತೆಂಗು	teṅgu/	COCONUT	ತೆಂಗು	ತೆಂಗು

APPENDIX - C

Symbols	BLACK & WHITE					ENHANCED		SEMI ENHANCED		COMMENTS	COLOURED					ENHANCED		SEMI ENHANCED		SUGGETIONS
	5	4	3	2	1	YES	NO	YES	NO		SUGGETIONS	5	4	3	2	1	YES	NO	YES	
ಬೆಕ್ಕು																				
ಚಂದ್ರ																				
ದಾಳಿಚಿ																				
ಚೆಂಡು																				
ಬೆಕ್ಕು																				
ಎಲೆ																				
ತಿಲಪ																				
ಚಿಕ್ಕ																				
ಬಿಣ್ಣಿನಿಗೆ																				
ಸರ																				
ಬಿಲ್ಲ																				
ಬಾತು																				
ಚೆಂಡು																				
ತೆಂಗು																				
ಧಂಟೆ																				
ದಿಲಪ																				
ತಿಲೆ																				

SUGGESTIONS	BLACK & WHITE					ENHANCED		SEMI ENHANCED		COLOURED					ENHANCED		SEMI ENHANCED		
	5	4	3	2	1	YES	NO	YES	NO	5	4	3	2	1	YES	NO	YES	NO	
																			COMMENTS
ಬೀಜಪುಷ್ಪ																			
ಬೀಜಪುಷ್ಪ																			
ಚಂದ																			
ಚಿಟಿ																			
ದಾಳಂಬಿ																			
ಕೇರುಳ್ಳಿ																			
ಕಿಳಿಗು																			
ಕಿಟಾಕು																			
ಕೋಲ																			
ಸುಧ																			
ಕೇರುಳ್ಳಿ																			
ಫತ್ತಿ																			
ಗಂಟಿ																			
ಕಿಟಿ																			

- 1 - Symbols are highly iconic. 5 - Symbols have least iconicity
- 2 - Symbols are very iconic.
- 3 - Symbols are fairly iconic.
- 4 - Symbols are less iconic.