THE IMPACT OF VISUAL SEQUENCING OF PICTURES ON THE PICTURE-BASED SENTENCE CONSTRUCTION OF ENGLISH-SPEAKING GRADE 2 LEARNERS

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ABSTRACT

The aim of this study was to determine the role of visual language input on PCS sentence construction. Thirty-nine participants were divided into two comparable groups and exposed to two inputs of presentations of PCS to investigate the impact of each input on the sentence construction of the participants. In the SVO input the sequence of buttons was in the normal English word order sequence (Subject-Verb-Object) and in the SOV input the word order was Subject-Object-Verb. Both input groups had to answer six questions by using PCS as well as speech. The findings indicated that the participants did not sequence their output to match the word order of the unfamiliar SOV input. The participants receiving the SOV condition used fewer PCS elements than the participants receiving the SVO condition. The participants receiving the SVO and SOV inputs gave similar spoken answers. Reasons for these findings are discussed, as are the implications for further research.

Key terms:

- Augmentative and Alternative Communication (AAC)
- Picture Communication Symbols (PCS)
- Sequencing
- Picture-based sentence construction
- Linguistic competence

ABSTRAK

Die doel van hierdie studie was om die impak van visuele taal inset op sinskonstruksie te bepaal. Nege-en-dertig kinders is in twee groepe gedeel en blootgestel aan twee insette. In die SVO inset is die normale Engelse woordorde gebruik (Subjek-Werkwoord -Objek) en in die SOV inset was die woordorde Subjek-Objek-Werkwoord. Die twee groepe moes dieselfde ses vrae eers met PCS en daarna met gesproke taal beantwoord. Die resultate wys dat die kinders nie die SOV orde in hul PCS- sinne gebruik het nie. Die proefpersone wat die SOV inset ontvang het, het minder PCS gebruik as die proefpersone, wat wel die SVO inset ontvang het. Die proefpersone het eenderse gesproke antwoorde gegee. Moontlike redes vir hierdie resultate en die implikasies vir verdere navorsing word bespreek.

Belangrike terme:

- Aanvullende en Alternatiewe Kommunikasie
- Opeenvolging
- Prentgebaseerde sinskonstruksie
- Taalvaardigheid

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CHAPTER 1
INTRODUCTION AND RATIONALE

1.1 PROBLEM STATEMENT

Augmentative and Alternative Communication (AAC) can be described as "an area of clinical practice that attempts to compensate either temporally or permanently for the impairment and disability patterns of individuals with severe and expressive communication disorders" (See http//www.isaac.dk). The main purpose of AAC is thus to enable AAC users to communicate more effectively. Various symbol sets and systems have been developed to provide a more functional means of communication for individuals with little or no functional speech (LNFS).

AAC research (Light, 1988; Basil, 1992 and Gandell & Sutton, 1998) focuses on the interaction between individuals with LNFS who use AAC systems and their significant others. While these interaction studies provide valuable information on the nature, pragmatic context and form of communication interactions, they are not a true reflection of the linguistic competence of AAC users (Soto & Toro- Zambrana, 1995). Linguistic competence can be defined on two levels. Firstly, AAC users must learn the syntactic, semantic and phonological rules of spoken language. Secondly, they must also learn the individual symbols of their own system and should be able to combine these symbols effectively. This pursuit of linguistic competence by AAC users is described by Light (1989) as a challenge.

Individuals with LNFS are often exposed to graphic symbols. Although information given by symbols is nearly always presented sequentially (Gibson, 1967), the sequencing of symbols on AAC devices has not received much attention. The "Fitzgerald key" recommends the left to right arrangement of symbols according to grammatical categories (Fitzgerald, 1949). Despite this earlier attempt, symbols are often placed on a communication board or overlay without much consideration of the impact that the input sequence of graphic symbols might have on the language development and use of AAC users.

The nature of the changes that might be induced by an unfamiliar input sequence of graphic symbols on the ability to answer questions by means of graphic symbols is a field that has thus far received little attention in research. Nakamura, Newell, Alm and Waller (1996) conducted research in this field, but on adults. The results showed that the adults used the English word order in both conditions. The unfamiliar input did not influence the sequence of the adults' PCS answers, as their language base was intact. Furthermore, adults tended to be more "flexible" and were more able to adapt to unfamiliar circumstances. The possible influence of different input sequences on the expressive abilities of younger participants has, however, not yet been studied.

To extend the knowledge base in this field the current study will investigate the impact of the sequencing of graphic symbols on the way in which children are able to answer questions using graphic symbols and compare these to their verbal answers to the same questions. This study will utilize two input conditions. In the SVO input condition the sequence of PCS will reflect the word order of spoken language. In the SOV input condition the sequence of PCS will not match the word order of spoken language and might therefore be more unfamiliar to the participants. The unfamiliar input sequence is more likely to influence children's ability to answer questions by means of graphic symbols. Children's language skills are still developing and the unfamiliar input sequence might confuse them as they will experience more difficulty in modifying their answers into graphic symbols. As a first step, this research was conducted on typically developing children to provide a basis for application to users with little or no functional speech. This information will thus enhance understanding of how typically developing children in Grade 2 (Age range: 7, 5 to 8, 5 years) are able to manipulate graphic symbols in the process of language learning.

1.2 DEFINITION OF TERMINOLOGY

The following terms need clarification.

1.2.1 Augmentative and Alternative Communication (AAC)

Augmentative and alternative communication "an area of clinical practice that attempts to compensate either temporally or permanently for the impairment and disability patterns of individuals with severe and expressive communication disorders" (See http//www.isaac.dk).

1.2.2 Picture Communication Symbols (PCS)

A symbol set of aided symbols composed primarily of simple line drawings with words printed above them (Lloyd *et al*, 1997, p. 537).

1.2.3 Communication board

A low technology communication device that displays aided symbols; for example, Bliss symbols or PCS (Lloyd *et al*, 1997, p. 526).

1.2.4 Little or No Functional Speech (LNFS)

Little or no functional speech refers to individuals who are able to use less than fifteen words intelligibly (Burd, Hammes, Bornhoeft & Fischer, 1983).

1.2.5 Language/Linguistic competence

Competence that consists of:

(a) Knowledge of the rules of syntax, semantics, and phonology necessary to produce and understand an unlimited number of grammatical utterances, and

(b) Mastery of an AAC system's symbol arrangements, leading to the ability to use the system to accomplish linguistic exchanges (Lloyd *et al*, 1997, p. 534).

1.2.6 Sequencing

Placing one word, symbol or picture after another in an orderly or continuous fashion (Hawkins, 1988, p 740).

1.2.7 Picture-based sentence construction

Picture-based sentence construction refers to the combination of picture-based symbols (such as Rebus, Picture Communication Symbols, PCS or Picture Ideogram Communication symbols, PIC) into sentences.

1.2.8 Scaffolding

The process by which competent interactive partners support the development of language abilities in children. The child's independence increases until he is able to master a task without any help (Brekke & Von Tetzchner, 2003, p 77).

1.2.9 Elliptical PCS utterances

The single symbol answer to an immediately preceding question.

1.2.10 Global PCS utterances

The production of a single symbol answer, while at the same time producing a complex spoken utterance.

1.2.11 Subject

The word or words in a sentence that name who or what does the action or undergoes what is stated by the verb (Hawkins, 1988, p 815).

1.2.12 Verb

The word or words in a sentence indicating action (Hawkins, 1988, p 907).

1.2.13 Object

A noun or its equivalent acted upon by a transitive verb or by its preposition (Hawkins, 1988, p 559).

1.2.14 Visual cueing

In this study, visual cueing refers to the sequence of the graphic symbols displayed on the picture-based communication device. The sequence of graphic symbols acts as a visual cue to assist the children with their picture-based answers.

1.3 OUTLINE OF THE CHAPTERS

Chapter 1 describes the rationale for this study; it provides clarification of the key terms used and an outline of the chapters. *Chapter 2* explores the role of language input as well as the unique language environment of the AAC user who is exposed to different input and output modalities. The impact of this mismatch is discussed. Furthermore, the role of graphic is discussed. Finally, the impact of the presentation of the input on children's language skills is explored. The methodology is described in *Chapter 3*. This includes a description of the aims, research design, pilot study, participants, material and equipment used in this study. It also describes the data collection procedure as well as the data analysis and statistical procedures. *Chapter 4* presents a description and discussion of the results. *Chapter 5* provides an integrated discussion of the results, followed by a critical evaluation of the study. The final section considers the implications of the study and offers recommendations for future research.

1.4 ABBREVIATIONS

AAC	-	Augmentative and Alternative Communication
LNFS	-	Little or No Functional Speech
PCS	-	Picture Communication Symbols
SVO	-	A sentence with speech parts in the order: Subject, Verb and Object
SOV	-	A sentence with speech parts in the order: Subject, Object and Verb

1.5 SUMMARY

This chapter provided the rationale for the study. It highlighted the need for research concerning the linguistic competence of AAC users. The chapter concluded with definitions of key terms and an outline of the chapters to follow.

CHAPTER 2
LITERATURE STUDY

2.1 INTRODUCTION

This study is concerned with understanding the relationship between information presented visually (through graphic symbols) and the impact of this graphic input on the output of children. Implicit in this association is a complex set of variables that need to be understood in order to facilitate the development of a more comprehensive understanding of the impact of the use of AAC graphic systems on the linguistic abilities and output of the individual.

To study this relationship, it is important to briefly describe the connection between input and output in language learning for typically developing children. Secondly, it is necessary to describe the unique language environment of the AAC user who is exposed to a different input and output system in efforts to communicate. This mismatch could impact language behaviour in various ways. For example, it may limit the expressive opportunities for the child, and it may impact on the word order of sentences that the child might use. A close look is taken at the role of graphic symbols. The last section in this chapter deals with the presentation of the input and its influence on the sequencing of symbols.

2.2 THE ROLE OF LANGUAGE INPUT IN LANGUAGE LEARNING

Hemmeter and Kaisser (1994) examined the impact of language input on children's productive language skills and global language development. This study involved 4 pre-school children with disabilities and their mothers. The children ranged in age from 25 to 49 months at the beginning of the study. Parents were taught to manipulate the environment in order to facilitate language development. They were encouraged to follow the child's lead and to expand and imitate his/her utterances. The participants showed increases in spontaneous communications. All of the participants learned their target language structures and used these structures productively. They generalized the new behaviour to their home and school environments. The results of this study suggest that systematic changes in language input can result in positive changes in children's productive language skills in both training and generalization settings and across conversational partners.

Experimental studies can provide insight into children's language development. Akhtar (2001) conducted an experimental study where he modelled novel verbs for 36 speaking children at 2,8, 3,6 and 4,4 years. One verb was modeled in the SVO order whereas two others were in the SOV and VSO orders. The children were then encouraged to use the verbs by asking a neutral question like "What's happening?" Almost all the children in all three age groups produced exclusively SVO utterances with the novel verbs, as this was the order of their input. However, when they received non-SVO inputs children behaved differently at different ages. The older children tried to correct the non-SVO orders to make them sound more like English. Most of the younger children, however, matched the ordering patterns that they had heard. This study recognizes the possibility of different responses based on children's varying perceptual, language and cognitive skills and unique language environments. Another important implication of this study is that children need sufficient data or language input before they can combine words into sentences. This explains why children utter their first words at approximately one year and only starts combining words into sentences at two.

These two studies represent only a fraction of the studies that support the environmental theory of language development. Children are exposed to language daily. Mothers modify their speech by, for example talking slower, using exaggerated stress patterns and talking about events in the here and now (Romski & Sevcik, 2003). Children learn by listening to the language being used in their environment. Initially, they imitate the adult model given to them, but they soon start to be more actively involved in the process of language acquisition. They consistently search for rules. Older children discern patterns or templates in the language they hear. They categorize, schematize and creatively combine individually learned structures (Tomasello, 2001).

Nativists, like Chomsky provide a different explanation for language acquisition. He believes that children have an innate ability to develop language (Chomsky, 1965). This universal grammar consists of the syntactic rules that are common to all languages of the world (Bloom, 1998). Chomsky's theory centres on biological factors within the child and does not concentrate on the external factors such as the environment. Children do not have to learn the features common to all human languages, because they are born with the necessary semantic, syntactic and phonological knowledge (Chomsky, 1965). This explains their rapid and effortless acquisition of language.

Pinker (1984) describes language learnability. He maintains that children are innately equipped with "linguistic universals" (Pinker, 1984, p359). These universal principles are triggered by the meaning of words in language input. Children use their own output to analyze subsequent inputs and consequently to formulate new principles of language development.

Even the most vehement nativists cannot maintain that all of language is innate. Vocabulary has to be learned and certain aspects of grammar are the product of the interaction between the child's innate knowledge and the language input received (Chomsky, 1965). It should be clear that language acquisition is complex and that environmental and biological factors should be considered. Language development should consider not only the child's intrinsic characteristics, but also the extrinsic factors that contribute to his learning environment (Hoff-Ginsberg & Shatz, 1982; Vygotski, 1978). The issue is this: exactly what is built into the child biologically and what kind of information is provided by the environment.

2.3 THE LANGUAGE ENVIRONMENT OF THE AAC USER

The nature and frequency of language input provided to AAC users differ significantly from the language input provided to typically developing children (Blockberger & Sutton, 2003). Language input of children with LNFS can differ because the facilitation of self-care skills and skills to improve independence could be important priorities for some children with LNFS. These caregiving activities require significant concentration and attention to positioning; making it more difficult to incorporate language learning experiences (Light & Kelford Smith, 1993).

AAC users tend to be passive communicators who provide single word responses to their partner's questions (Harris, Doyle & Haaf, 1996). Some AAC users only express themselves when they are obliged to do so. They do not initiate conversation (Light, 1988). Parents are their children's main communication partners (Von Tetzchner and Martinsen, 1996). A partnership implies that the responsibility for communication is shared. Parents of children who use aided communication must, however, also assist in articulating their children's messages. This double role of parents might cause them to take control of interaction. They talk continuously and have to be encouraged to pause and to encourage initiations and more turn-taking. Parents have to provide scaffolding to support language learning (Light, 1997). Caregivers of very young children will, for example, support verbal messages with enough verbal and nonverbal information to ensure understanding (Rokoff, 1998). Initially, adults respond to any attempt of the child to participate and they attribute intention to these attempts. The parents of typically developing children gradually relinquish control. They give less input and expect more participation from their children. Parents of children with LNFS continue to provide scaffolding even when the child has developed the language abilities to participate independently. This strategy can impede the ability of children with LNFS to actively participate in language development and can actually conceal their communication problems and potential (Von Tetzchner & Martinsen, 1996).

The nature of language input to AAC users can influence their language development. Their ability to extract rules from interactions might be compromised by their disability, by the reduced exposure to language learning as well as limited expressive opportunities and also a difference in the nature of the input. Although AAC users are a heterogeneous group, some general interaction patterns can be identified. The language input provided to AAC users is often structured and planned (Soto, 1999). They receive guidance on how to use their AAC device in the therapy situation with their family members, but lack input on how to generalize these skills to unfamiliar communication partners and contexts.

Parents of children with LNFS may employ a more directive approach to language development (Blockberger & Sutton, 2003) even though a responsive rather than a directive style facilitates language development. It has been noted that dialogues involving children using communication aids contain a high proportion of turns where the partner asks questions, especially yes/no questions (Von Tetzchner & Martinsen, 1996). The child may not have a specific symbol to express a particular meaning. Parents will then utilize yes/no questions in order to decipher the child's intended meaning. They are more concerned about maintaining interaction than about fostering formal language skills (Von Tetzchner & Martinsen, 1996). The children are not expected to make sentences. They can answer questions by providing single symbol utterances.

Another factor that makes the AAC users' language environment unique is the asymmetry between the input and output modalities.

2.4 INPUT –OUTPUT ASYMMETRY

Most AAC users utilize two coexisting communication modes (Soto & Toro-Zambrana, 1995). They are immersed in a spoken language environment as the input they receive is predominantly spoken, while they typically use an AAC system as an expressive communication mode. This creates an asymmetry between input and output communication systems.

Bilingualism and the asymmetrical relationship between the language modes of some users of alternative language are two significantly different situations. Two important differences exist between bilingualism and AAC communication:

- Bilingualism involves the translation from one language to another where as the input-output asymmetry requires the modification of the spoken input into a non-verbal mode of communication.
- Another difference between the bilingual situation and the relationship between graphic symbols and spoken language is that bilingual people can communicate with other people using the same language (Von Tetzchner, Grove, Loncke, Barnett, Woll, & Clibbens, 1996). With users of AAC, however, it is different as they generally live within speaking communities. They do not receive models of how other people use AAC systems for communication.

Hearing AAC users can acquire receptive language through interaction within regular community interactions. These receptive abilities thus provide a base for expressive language development. The association between expressive and receptive language development is important as children also learn to comprehend language by participating in interactions. Although the AAC user can acquire receptive language, the inability of the individual to participate in interactions could significantly impact on his language development (Light, 1997).

The nature of the impact of using a graphic communication system with certain expressive limitations on the language development of the individual is thus of interest. Adults, who use graphic symbols as their expressive communicative system will recode a speech-based message into graphic symbols with relative ease. Children's ability to modify a speech-based message into a graphic medium can improve as they grow older and as their metalinguistic skills improve. They have to be able to discern different communication modes and have to know how to modify messages into another mode.

It is important to take a closer look at the characteristics of output by means of graphic symbols. This might give us insight into the impact of a different output mode on language development.

2.5 CHARACTERISTICS OF OUTPUT BY MEANS OF GRAPHIC SYMBOLS

Most of the data concerning output by means of graphic symbols refers to the persistence of single word utterances and minimal structural expansion. Udwin and Yule (1990) compared twenty Bliss users and twenty sign users' syntactical development. They reported that half of the utterances recorded in their study were one symbol in length. Over a period of 18 months, they saw more two-symbol utterances, but the complexity of the utterances remained the same. This particular study has certain limitations. The authors themselves mention the lack of an adequate methodology to transcribe and interpret the multi-modal nature of AAC communication. Furthermore, the focus on conversational exchanges does not give a true reflection of the linguistic capabilities of AAC users.

In the light of these comments, Soto and Toro-Zambrana (1995) studied the morpho-syntactic complexity of the output when using Bliss symbols. The participants in this study were three physically disabled Spanish adults who used Bliss symbols as their primary means of expression. These authors utilized sentence translation, picture interpretation and spontaneous conversation to elicit and observe language production. This study concluded that the Bliss symbol system facilitates the formulation of a wide variety of messages using complex language structures and emphasized the importance of compensatory strategies to overcome expressive limitations.

Smith (1996) studied five speaking children using communication boards. The youngest child in this study could not use the communication board for communication. The other four children produced essentially single-PCS utterances. When they produced multi-term utterances they did not order the elements within the linear order constraints of English. This study attempted to find reasons for the restricted outputs. The children in this study produced “reduced” Picture Communication Symbol (PCS) outputs despite their intact receptive and expressive language abilities. The graphic medium itself has an effect on expressive language skills. The research suggests that communicating with PCS is completely different to communicating with speech. PCS symbols can be seen as ‘wholes” and this might make it difficult to combine individual PCS into sentences with these symbols. It is also evident that word order constraints are more difficult to apply in the graphic medium.

When using graphic symbols the AAC user has to modify an internal speech message into an alternative modality. This process requires metalinguistic skills. Another characteristic of output by means of graphic symbols is that somewhere in the process of recoding to a graphic medium the order of the constituent’s changes. Sutton and Morfield (1998) explored the relationship between word order and age. They asked 32 children between the ages of 5, 9 and 12, 7 to retell events on videotape by firstly pointing to pictures available on a board, and then by using speech. They concluded that the use of English word order increased with age, but was not at a ceiling, even among the oldest children. Their findings indicate that the use of the non-English pattern was not random. OV phrases were more prevalent than non-OV phrases. Sutton and Morfield (1998) suggest that the OV order might serve as a transitional step between single constituent responses and full SVO responses.

2.6 THE ROLE OF GRAPHIC SYMBOLS

Using graphic symbols in language input can assist in the development of speech comprehension. Graphic symbols can serve as a supplementary visual input to the auditory input which children receive. They might obtain additional information from this visual input that will expand their receptive language. The use of graphic symbols in language input can effectively restore the mismatch between the input and output modalities (Romski & Sevcik, 2003). The AAC user receives a model of graphic symbol use and this may facilitate frequent symbol use.

The use of graphic symbols places language, cognitive and perceptual demands on the AAC user. If the communication partner is modelling the use of an aided AAC system employing graphic symbols, the child's attention is divided between the spoken words and the graphic symbols (Blockberger & Sutton, 2003). AAC users must know the symbols of their system and how to combine these symbols. They must remember their message and keep track of which symbols they have used and which ones they must still use (Light & Lindsay, 1991).

Although the old Chinese proverb states that one picture is worth ten thousand words, and we have come to depend on pictures and diagrams as important aids in communication, the capacity to obtain information from pictures is a learned skill that children acquire gradually and often only after much teaching (Behr, 1971). The use of pictures of objects as symbols is a complex skill that requires a person to treat a picture as standing for its referent in a variety of contexts. It is also important that the person must realize that the symbol is a separate entity that is, it is separable from its referent (Stephenson & Linfoot, 1996).

Information given by symbols is nearly always presented sequentially (Gibson, 1967). The receiver must take account of the order of the events. The difficulty in learning to respond to symbol sequences is not only due to the demands of memory, but also to the combined effect of the symbols. In the light of these comments it would be interesting to explore the impact of visual sequencing of pictures on picture-based sentence construction

2.7 THE PRESENTATION OF THE INPUT

Light, Drager, McCarthy *et al* (2004) investigated the impact of the organization of the symbols on the participants' ability to learn PCS. Eighty typically developing children participated in the two studies: 40 four-year-olds and 40 five-year-olds. They were exposed to the following organization techniques: a taxonomic grid, a schematic grid, a schematic scene and iconic encoding. In a taxonomic organization, vocabulary is grouped on separate pages according to categories like people, actions or things. Schematic organizations group vocabulary according to event schema such as getting ready for school. Encoding techniques used PCS symbols in combinations as codes to retrieve single words or phrases. Both the 4- and 5-year-olds were more accurate in locating target vocabulary in the three dynamic display conditions (taxonomic grid, schematic grid, and schematic scene) than in the iconic encoding condition. The children's rate of learning with the iconic technique was significantly slower than the rates for the three other organization techniques for both 4 and 5-year-olds. Dynamic display conditions posed less cognitive demands on the children, as each concept was represented by a graphic representation utilizing a one-to one correspondence of the PCS with the semantic concept whereas iconic representations expect associative links between the icons and the semantic concepts. Most errors resulted from the children going to the wrong page in the dynamic display conditions. Furthermore, the participants struggled to use the systems spontaneously. The authors concluded that AAC systems should be designed to reduce the learning demands for young children. It is also important to explicitly teach the organizational structure of the AAC system. It is thus clear that the organization of symbols have an impact on children's ability to learn symbols. The question that remains to be answered is how the organization of symbols influences children's expressive language.

Nakamura *et al* (1998) asked English-speaking adults to compose picture-based sentences using a computer-based system. This particular study utilized two conditions to analyze the impact of symbol ordering on picture-based sentence construction. In the SVO-condition, the symbols were in the normal English word order sequence (Subject-Object Verb) and in the SOV- condition; the symbols were in the usual Japanese word order sequence (Subject-Object-Verb). Twenty- one subjects were assigned to the SVO condition and 22 subjects were assigned to the unfamiliar SOV condition. The results showed that the English subjects used English word order in both conditions. One limitation of the study by Nakamura *et al* (1998) is that they used a written paragraph with reading comprehension questions to elicit the graphic sentences. It is possible that their subjects transferred the written order onto their picture-based constructions. Soto

(1999) identified the organization of the sign options according to their function in the sentences as the reason why the subjects in this study used English word order sentences. Furthermore, the availability of morphological markers may influence the constituent order of AAC utterances. It must also be emphasized that the participants in this study were fluent mother-tongue speakers. As mentioned in Chapter 1, the unfamiliar input sequence is more likely to influence children's ability to answer questions by means of graphic symbols as their language base is still developing. The unfamiliar input might make it more difficult for the children to modify their PCS answers into the graphic medium. Their ability to modify messages from speech into graphic signs might still be developing.

The current study was conducted due to the limited research on the impact of the presentation of information on picture-based sentence construction of children. Knowledge concerning the impact of visual input could assist us to successfully merge the AAC user into graphic communication. Sufficient and appropriate language input can place the AAC user on the road to linguistic competence.

2.8 SUMMARY

In this chapter, emphasis was placed on the role of input in language learning. The unique language environment of the AAC user was explained. The input-output asymmetry seen in graphic communication is discussed and the impact of this asymmetry is explained. The use of graphic symbols can restore the symmetry between the input and output modalities. The sequencing of symbols and its impact on the language of AAC user is discussed.

CHAPTER 3
METHODOLOGY

3.1 INTRODUCTION

The research methodology is described in this chapter. The research question, design, participants, pilot study and data collection procedure are discussed. A description of the material and equipment used is provided. Finally, an account is given of the data analysis procedure.

3.2 RESEARCH QUESTION

What is the impact of the visual sequencing of pictures on the picture-based sentence construction of Grade 2 English-speaking children?

Sub-questions:

3.2.1. What is the effect of picture-based sentence construction on the number of elements used to construct sentences?

3.2.2. What are the differences between picture-based sentence construction and verbal sentence construction?

3.3 RESEARCH DESIGN

This study follows a quasi experimental design by which the participants were randomly assigned to the SVO and the SOV inputs. In the SVO input the sequence of buttons in the "Choose a category" section was in the normal English word order sequence (Subject-Verb-Object) and in the SOV input the word order was Subject-Object-Verb. The participants were trained as a group. They were divided into four cohorts to ensure effective training. Each cohort consisted of 5 children who received SVO input and 5 who received SOV input. There was an even distribution of male and female participants. Furthermore, the cohorts were seen on four consecutive days. See Table 3.1 for an explanation of the cohorts. The training included teaching of the categorization process needed to select a PCS symbol, practising the combination of PCS into sentences and listening to "The Apple Boy" (original story used by Nakamura *et al* 1996). The testing procedure involved observing each participant individually. They listened to the story (second exposure) and answered 6 questions about it. These questions had to be answered by combining PCS symbols into sentences and then the same questions had to be answered in spoken sentences.

Table 3.1 Division of participants into smaller cohorts

DAY	**COHORT**	**SVO INPUT**	**SOV INPUT**	**VERBAL ANSWERS**
1	A	First	Second	Third
2	B	Second	First	Third
3	C	First	Second	Third
4	D	Second	First	Third

3.4 DESCRIPTION OF PARTICIPANTS

3.4.1 Selection criteria

Table 3.2 summarizes the selection criteria, the rationale for including the participants in the process and the procedures used to evaluate them.

Table 3.2 Selection criteria

CRITERIA	MOTIVATION AND PROCEDURE USED
1.***Age*** Grade 2 English-speaking children. Age range :7,5 to 8, 5 years.	Light *et al* (2004) maintained that school- age children learn skills in hierarchical organization. Around the age of eight children typically understand word classes (Wadsworth, 1989).
2. ***Gender*** There must be an even distribution of male and female participants.	Nakamura *et al* (1996) included an approximately equal number of male and female participants in their study.
3. ***Mother-tongue English speaking children*** English must be the primary language spoken at home.	Miller (1984) stated that the second language might interfere with the articulatory settings, syntactic patterns and morphology of the other language. These criteria were determined by information gathered from the respective teachers.
4. ***Normal language*** Participants must have no language disabilities.	Northwestern Syntactical Screening tests were conducted to ensure that the participants' grammatical development was normal. Participants' receptive and expressive scores had to be above the 25 percentile to be included in the study.
5. ***Familiarity*** Participants must have had prior experience with computers and must be able to use a mouse.	Participants had to use the computer to select the chosen symbols to answer questions. The selected children had attended computer classes at their school for at least 2 years. This information was gathered from teacher reports.
6. ***Visual Acuity*** Participants' vision should be normal or aided to an extent that does not inhibit functioning	Participants required good vision to be able to work on the computer. This information was determined by teacher reports.
7. ***Hearing*** Participants should have normal hearing.	Participants had to be able to follow the verbal instructions given by the computer. The teachers were asked to exclude children with hearing problems.

3.4.2 Descriptions of participants

Forty-eight children qualified for inclusion in the study. They attended a private school in the Pretoria area. The screening tests (Step 1 in the flow chart, Appendix B) eliminated five of these children, as they did not pass the Northwestern Screening test. One child was excluded because he was not fluent and he was referred for treatment. Two children were excluded as they were receiving occupational therapy. Participant 12 was absent on the day his cohort was tested and was thus not included. The final number of participants was thirty-nine.

3.4.3 Comparing the participants in the SVO and SOV inputs

Thirty-nine participants were randomly assigned to the SVO or SOV inputs (See Step 2 in Appendix B). As mentioned earlier, there was an even distribution of male and female participants in the SVO and SOV inputs and all the participants had received 2 years computer training at their school. Furthermore, Table 3.3 compares the participants who received the SVO and SOV inputs in terms of age, expressive language and receptive language scores.

Table 3.3 Participants in the SVO and SOV inputs

	SVO input		**SOV input**		**P-value**
	Mean	**SD**	**Mean**	**SD**	
Age	7.84	3.19	7.88	4.29	0.74
Expressive language	63.99	27.89	63.99	27.89	1,0
Receptive language	25.00	0.00	28.74	12.23	0.15

This table indicates that the participants were as homogenous as possible in terms of age, expressive language and receptive language. All the P-values were above 0.05 and thus indicate that there was no statistical difference on the 5% level between the participants who received the SVO input and those who received the SOV input.

3.5 PILOT STUDIES

3.5.1 Aims

- To determine whether the participants understood the categorization process.
- To ascertain whether the participants understood picture-based sentence construction.
- To observe the participants' level of interest in the story and the procedures.
- To determine whether the participants understood the instructions.
- To calculate the time needed for the procedure.
- To identify potential responses or lack of responses and to decide on the corresponding action.
- To test the efficiency of the system that would be used in data capturing.

3.5.2 Participants

Pilot study 1: Four Grade 0 learners

Pilot study 2: Ten Grade 1 English-speaking children were randomly assigned to the SVO option (Subject Verb Object) or the SOV option (Subject Object Verb).

3.5.3 Procedure, results and recommendations

Tables 3.4 presents the procedures, results and recommendations for Pilot Study 1.

Table 3.4 The procedure, results and recommendations for Pilot Study 1

Procedure	Results	Recommendations
Four Grade 0 children were seen in a group and asked to sort eight PCS into People, Actions or Things categories. This step was paper- based. Each participant had his/her own symbols and People, Actions and Things cards (See Appendix H).	The sorting process lasted 30 minutes. Although additional time was allocated, the participants still could not sort the PCS correctly.	It was therefore decided to use Grade 2 participants in the main study. The researcher used Grade 1 learners from the selected school for the second pilot study. This was done to ensure that there would be a sufficient number of Grade 2's for the main study.

Tables 3.5 presents the procedures, results and recommendations for Pilot Study 2

Table 3.5 The procedure results and recommendations for Pilot Study 2

Procedure	Results	Recommendations
Ten Grade 1 participants were seen in a group and asked to sort 8 PCS into the People, Actions or Things categories. As before, this step was paper-based and the participants were seen in a group. Each participant had his/her own symbols and cards (See Appendix H). The sorting process lasted 10 minutes.	The participants could sort these 8 PCS correctly, but asked for assistance or reassurance	It was therefore assumed that Grade 2 participants would be able to complete this task more independently.
The Grade 1 participants had to construct four PCS sentences with the 8 PCS given to them. This step was paper- based and the participants were seen in a group.	They completed two out of the four sentences correctly.	It could be postulated that the Grade 2 learners would be able to complete the four sentences in the 10 minutes allocated for the sentence building.

The Grade 1 participants had to listen to the adapted version of the "Apple Boy story" (See appendix C). This step was paper-based and the participants were seen in a group. The researcher read the story and presented the story illustrations (See Appendix F).	This step took about 5 minutes to complete. The participants enjoyed the story and listened attentively.	
The participants had to listen to the story on the computer. The computer presented the story as recorded by the researcher and did not include illustrations. Each participant was seen individually.	This step took about 3 minutes to complete. This was the participants' second exposure to the story and they lost interest towards the end.	The 8 story illustrations will be used in conjunction with the computer's presentation in the main study. The participants were told that they had to listen to the story again to make sure that they had not forgotten anything and because they had to answer some questions about the story
Each participant was seen individually and had to build 4 PCS sentences.	This step took approximately 5 minutes to complete. The participants were eager to work on the computer and successfully completed the sentence-building task.	
The participants had to answer questions about the story using PCS symbols. This step was computer-based and each participant was seen individually.	The participants had some difficulty with the original questions. They understood the instructions.	The questions were therefore adapted (See 3.6.3). It was important to identify potential responses to these questions during the pilot study, as the researcher had to decide how to respond to each possibility.

Table 3.6 describes the potential responses and the corresponding reactions.

Table 3.6 Potential responses/lack of response and corresponding reaction

Participants' response	Instruction from the researcher
Participant does not respond or says that he/she does not know."	"Click on the People, Actions and Things button."
Participant does not click on any of the options.	"Please click on a picture to answer the question." Repetition of the question. Help the participant to formulate the answer. "What are you trying to say? Where will you find that?"
Participant answers the question verbally	"Remember you have to answer the question by building a sentence with pictures."
Participant does not indicate that he is finished with a sentence.	"Are you finished? Click on the finished button."

3.6 MATERIAL USED IN THIS STUDY

3.6.1 The picture-based communication system

The picture- based communication system was developed on a personal computer (PC) using the picture communication system construction package Boardmaker (Mayer-Johnson^{TM} Co.) and the software program Visual Basic. A mouse-driven interface was provided. Three buttons were displayed on the screen corresponding to the three basic parts of speech: a subject button (people), a verb button (action), and an object button (things).

Each of these buttons, when activated, provided a list of appropriate PCS (See Figure 3.1), and participants could then choose one of the PCS.

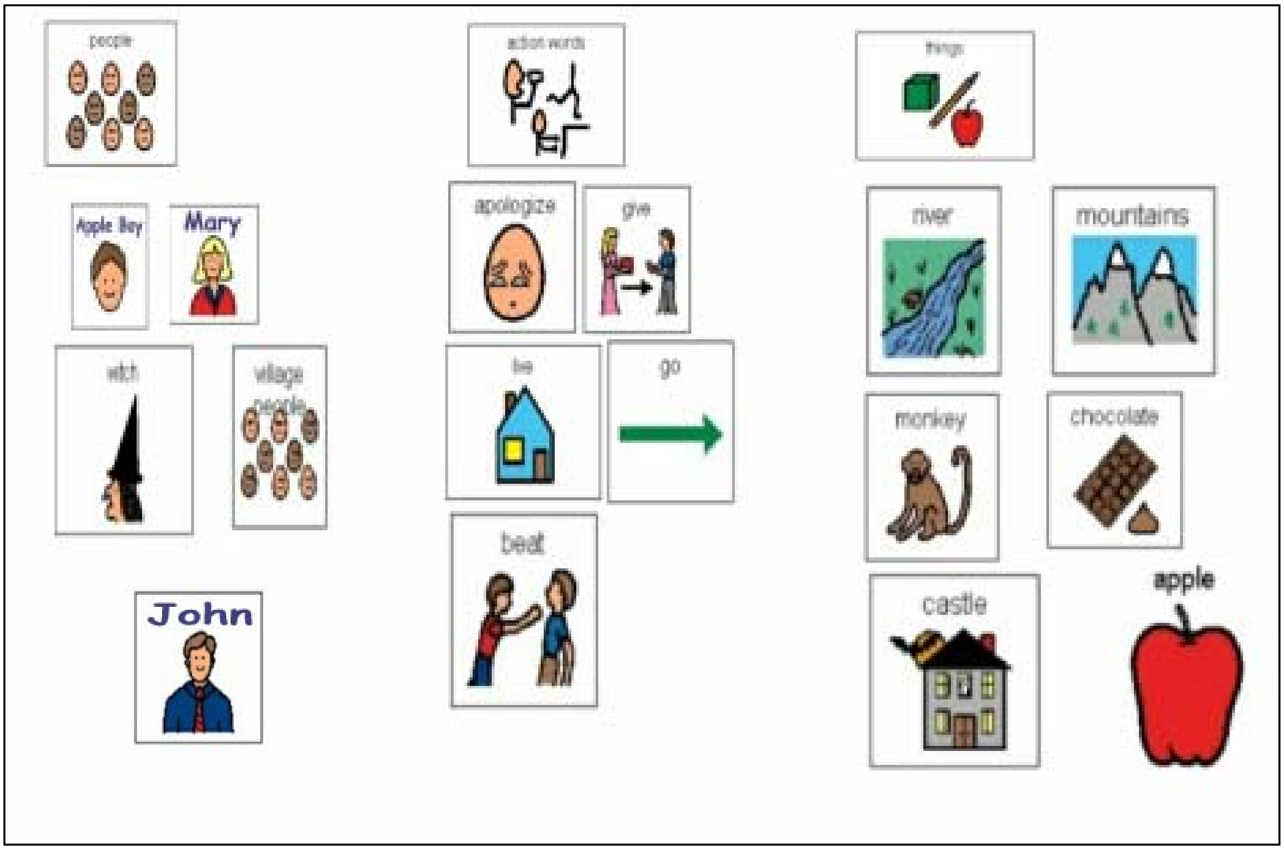


Figure 3.1 The picture-based communication system

For example, if a participant touched the subject button, five PCS representing subjects (namely John, Mary, Witch, Apple Boy and village people) were displayed. When the participant chose a particular subject, the selected symbol was displayed on the screen and the computer spoke the corresponding word.

A visual cue (moving face) was provided to assist the participants in finding their marker on the screen. A button was included to delete unwanted symbols. The learners indicated that they had completed a question by clicking on the "finished" button. The computer recorded the participant's responses, including deleted symbols. The log file of Participant 13 (See Table 3.7) illustrates this.

Participant 13 answered question 2 as "John beat monkey". She deleted "beat" and "monkey" and selected "mountain" and "monkey". This means that her final sentence reads, "John mountain monkey". By including the deleted symbols, some insight into the underlying process of PCS sentence construction can be acquired.

Table 3.7: Log File for Participant 13 (Questions 1 & 2)

Question 1 Where did the witch live?
Model answer: Witch live castle
Participant 13's response
Selected Category: People
Selected Object: C: Witch
Selected Category: Actions
Selected Object: C: Live
Selected Category: Things
Selected Object: C: Castle
Question 2 Where did John go?
Model answer: John Go Mountain
Participant's 13's response
Selected Category: People
Selected Object: C: John
Selected Category: Actions
Selected Object: C: Beat
Selected Category: Things
Selected Object: C: Monkey
Undid previous object
Undid previous object
Selected Object: C: Mountain
Selected Object: C: Monkey
Selected Next Sentence.

3.6.2 The story

Nakamura *et al* (1996) developed a picture communication system and a set of questions based on the Japanese folk story "Momo-tarou" (The Apple Boy). They described the composition of picture-based sentences by university students. The current study will attempt to utilize this story to describe the composition of PCS sentences by Grade 2 participants. Adaptations had to be made to the story due to the age and culture differences of the participants. Grade 2 learners would not have been able to understand some of the words, phrases and sentences used in the original story. The relevant Grade 2 teachers were asked to subjectively evaluate the story. The teachers' suggestions and the pilot study results were used to make the necessary adaptations. These adaptations are presented in Table 3.8. See Appendix C for the original and adapted stories.

Table 3.8 Adaptations made to the story

Original story	Adaptations
A married couple, John and Mary were living…	John and Mary were living…
Sometimes a witch who lived in the castle came to the village to rob the people of their money.	Sometimes a witch who lived in the castle came to the village to steal the people's money.
The couple named the baby Apple Boy and fostered him.	John and Mary named the baby Apple Boy. They loved him very much and took good care of him.
The monkey was so pleased that it promised to help the Apple Boy to challenge the witch.	The monkey was so pleased that it promised to help the Apple Boy to fight the witch.
With the cooperation of the monkey, the Apple Boy could beat the witch.	With the help of the monkey the Apple Boy could beat the witch.

3.6.3 The questions

The original questions as used in the study by Nakamura *et al* (1996) were adapted after the pilot studies and in consultation with the Grade 2 teachers.

The question "Where did Mary and John go respectively?" was changed into two separate questions namely:

Question 2: "Where did John go?"
Question 3: "Where did Mary go?"

The question "On the way to the castle, what did the Apple Boy give and to whom? was changed to "What did the Apple Boy give and to whom?
"What was the result of the challenge between the Apple Boy and the witch?" was changed to "The Apple Boy and the witch had a big fight. What happened?"

Appendix C presents the complete list of original questions and the changes made to them for the purpose of this study.

3.6.4 The story illustrations

Eight illustrations (See Appendix F) were made using the Boardmaker program.

Picture 1: John and Mary

Picture 2: The witch and her castle

Picture 3: John at the mountain and Mary at the river.

Picture 4: Mary washes clothes at the river. An apple floats towards Mary.

Picture 5: A baby is born from the apple.

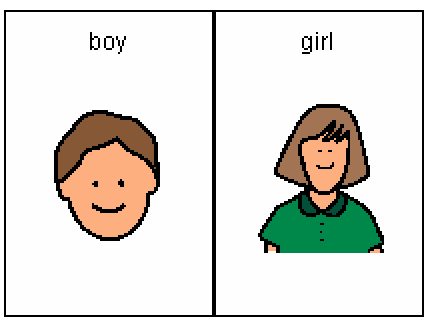
Picture 6: The Apple Boy gives a chocolate to the monkey.

Picture 7: The fight.

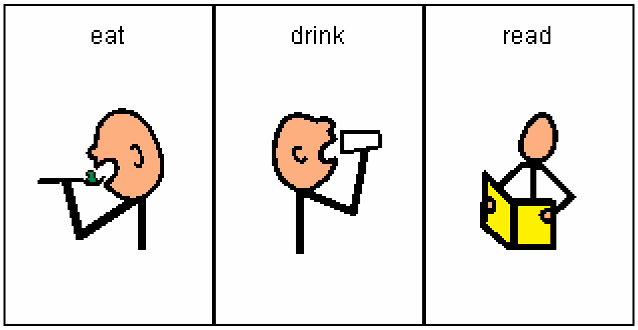
Picture 8: The witch apologizes to the village people.

3.6.5 PCS symbols used in the training

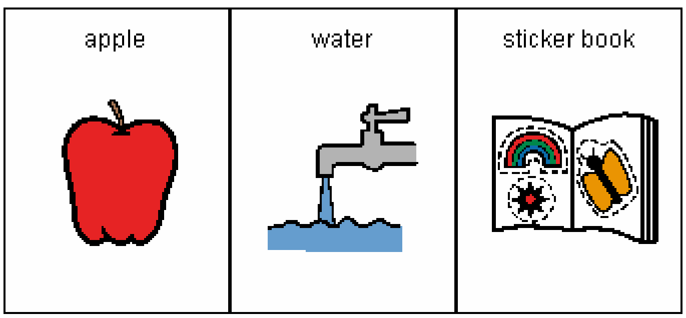
"People" PCS



“Actions” PCS



“Things” PCS



All the participants had their own PCS and People, Actions and Things cards. They had these symbols in front of them during the training procedure (See Appendix H).

3.7 EQUIPMENT USED IN THIS STUDY

- A Daewoo tape recorder with a built-in microphone
- A Mecer laptop computer with an external mouse
- TDK 60 minute Audio tapes

3.8. DATA COLLECTION PROCEDURE

3.8.1 General

- The researcher escorted the participants to the room and back to their classrooms.
- The first few minutes of the session were used to introduce the participants to the researcher and the computer room.
- At the end of the session the participants received verbal and non-verbal praise. Non-verbal praise was in the form of a star sticker and the verbal praise was, "Thank you, you worked well today".
- A detailed script with the verbatim instructions is included in Appendix E

3.8.2 Training procedure before testing

Step 1 was the screening of the children who qualified for the study. In step 2 the participants were randomly assigned to the SVO and SOV inputs and step 3 was the pilot studies. That brings us to the training procedure. The training included teaching the categorization process needed to select a PCS symbol (Step 4), practising the combination of PCS into sentences (Steps 5 and 7) and listening to "The Apple Boy" (Step 6). See Appendix B for a flow chart of the study. The training procedure was audio-recorded.

Step 4 Categorization training

- The participants were trained in four cohorts of 10 participants each. This step was paper-based.
- The researcher explained the concept of graphic communication and introduced the PCS symbols and the categorization process.

- The participants placed the symbols on their own People, Actions and Things cards.
- The researcher assisted the participants during this task.

Step 5 Training of picture-based sentence construction

- The participants were trained in a group. This step was paper-based.
- Four trial stimuli situations were provided for the participants to familiarize themselves with picture-based sentence construction.

  Sentence 1: Boy reads book.

  Sentence 2: Boy drinks water.

  Sentence 3: Girl reads book.

  Sentence 4: Girl eats apple.

- The participants were introduced to the concept of picture-based sentence construction. The three cards were placed in front of each participant in the following order: People, Actions and Things. The participants were then encouraged to build sentences 1 and 2.

- The researcher did not influence the order which they chose and placed the pictures. The participants chose the symbol, were assisted to find the desired symbol and placed the chosen symbols next to each other in order to build sentences 1 and 2.

- The cards were then placed in the order People, Things and Actions and the participants were required to build sentences 3 and 4.

Step 6 The story

- This step was paper-based.
  The researcher read the story verbatim (See Appendix C) and showed the eight illustrations.

Step 7 Building PCS sentences on computer

- This step was computer-based and the participants were tested individually. Each participant clicked on the sentence. The computer asked them to click on the "People", "Actions" or "Things' button and to choose one of the "pictures" to build the sentence. The selected symbol was displayed on the screen and the computer spoke the corresponding word. Figure 3.2 shows a screenshot to illustrate this.

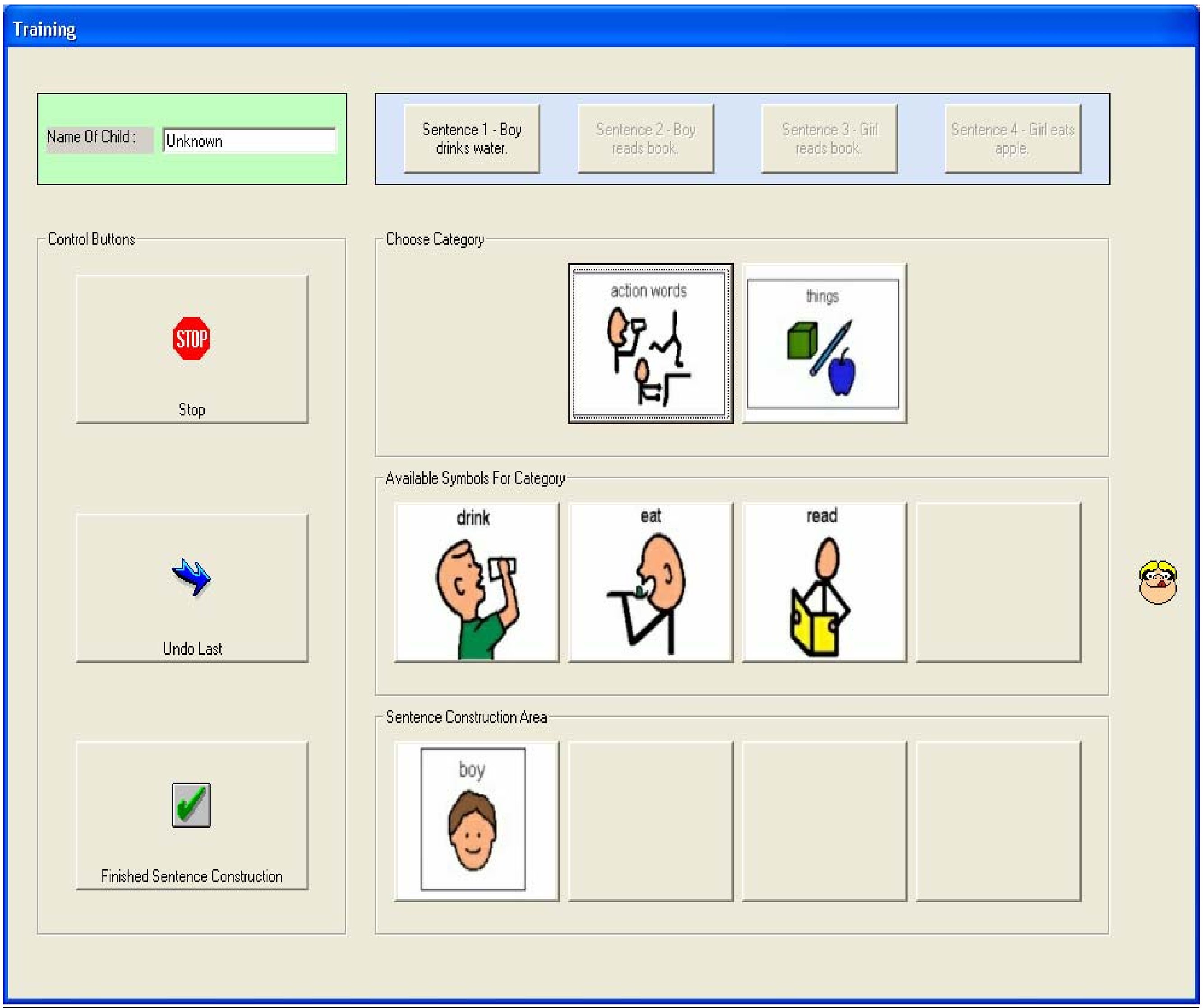


Figure 3.2 Screenshot of PCS sentence construction

3.8.3 Testing procedure

Step 8 Second exposures to "The Apple Boy" story

The participants listened to a recorded version of the "Apple Boy" on the computer. The illustrations were shown as the computer told the story. The participants were told that they had to listen to the story again, because they had to answer some questions about the story.

Step 9 Explaining the screen, introducing the symbols and giving instructions

The participants were introduced to the PCS that they had to use in order to answer the questions. The researcher clicked on the people button and pointed to and verbalized all the available symbols. The same procedure was followed with the "Actions" and "Things" buttons. The researcher introduced some of the important buttons on the screen by reading the written script (See Appendix E).

Step 10 Answering questions with PCS sentences

Each participant answered 6 questions by choosing and selecting PCS symbols on the computer to form sentences. When the participant chose a particular symbol, it was displayed on the screen and the computer spoke the corresponding word. Figures 3.3 and 3.4 provide screenshots of Questions 1: SVO input and Question 1: SOV input respectively. They had to click on the finished button to go on to the next question. Responses were automatically saved on the computer (See Appendix D).

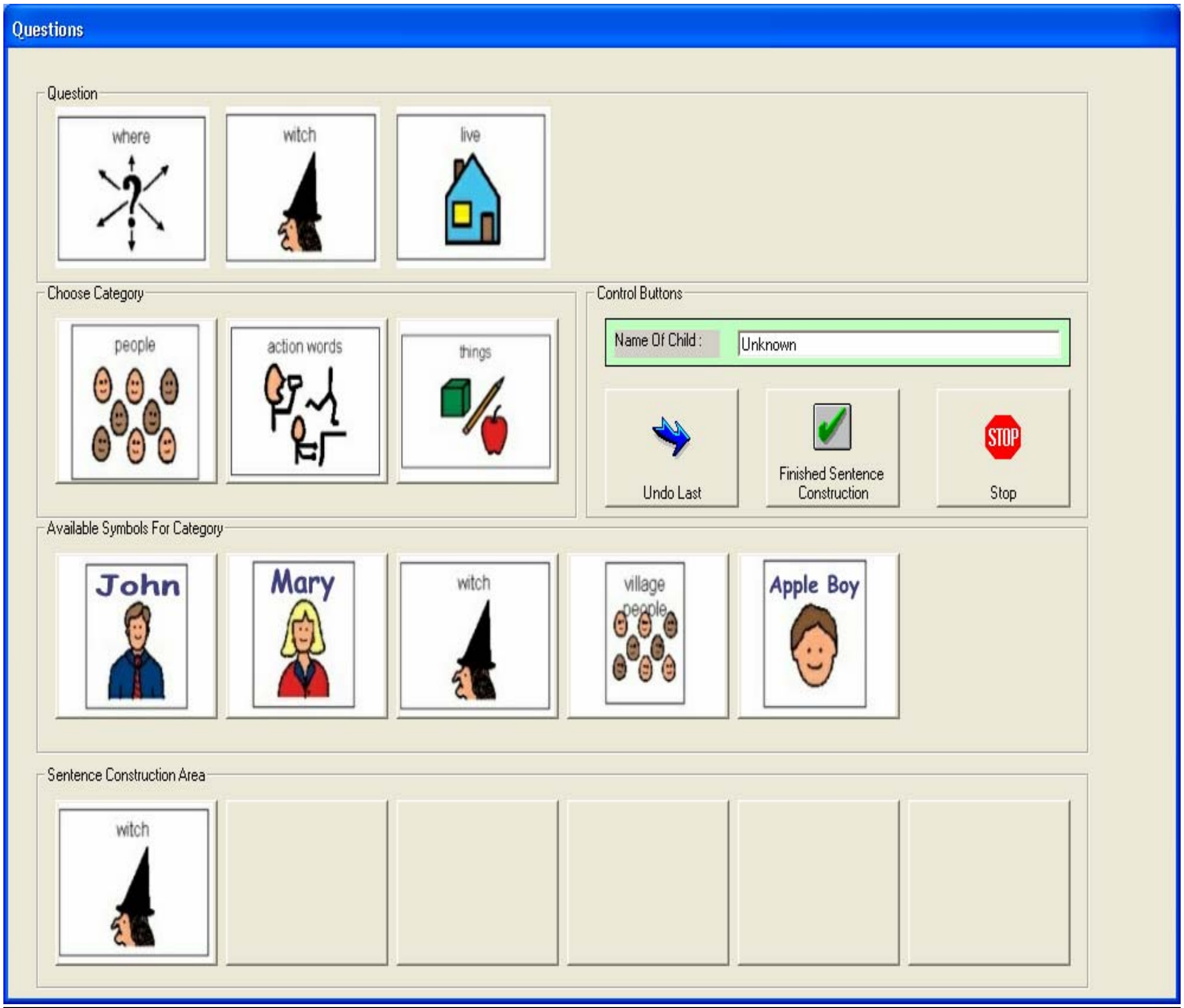


Figure 3.3 Answering questions using PCS: The SVO exposure

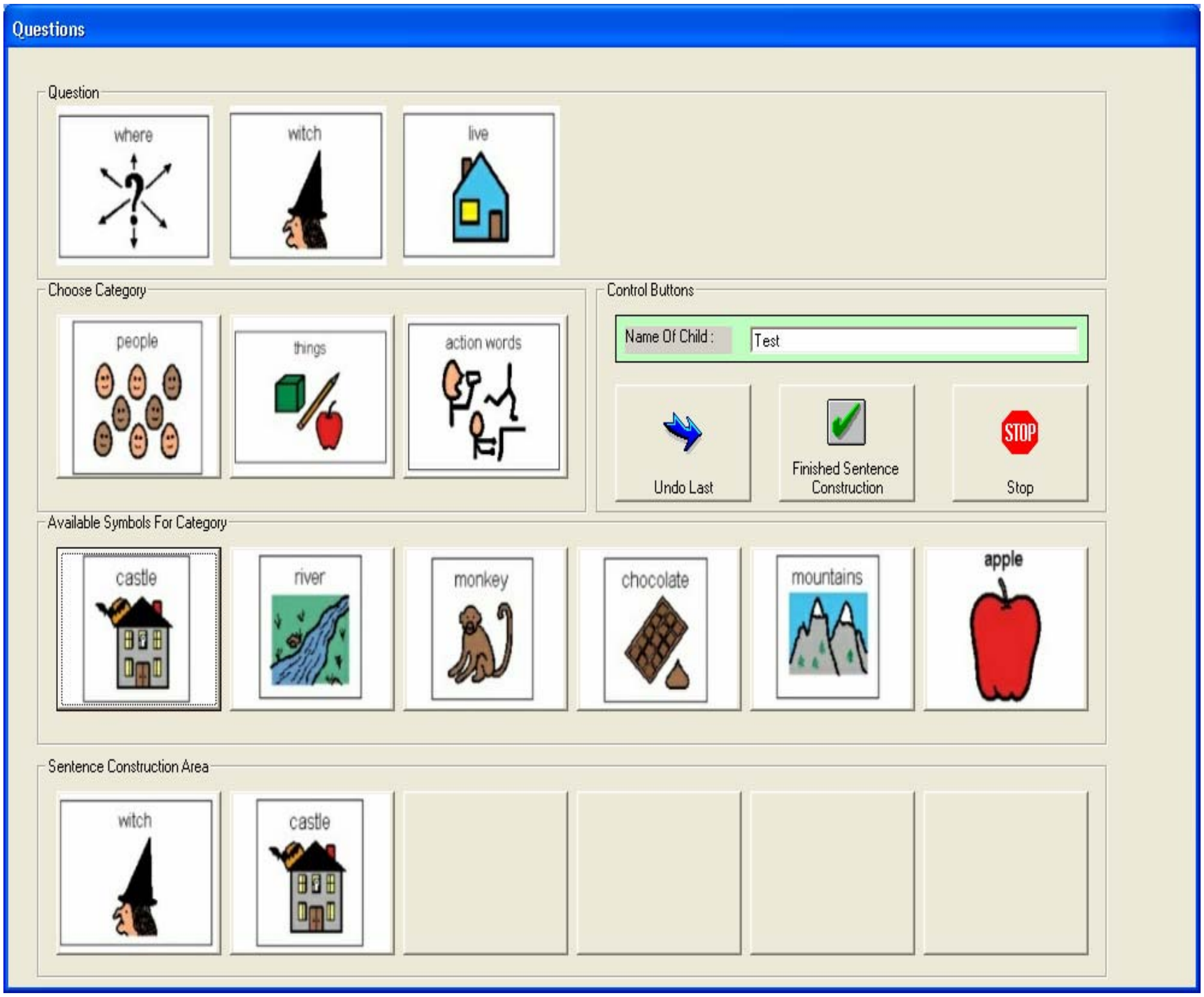


Figure 3.4: Answering questions using PCS: SOV exposure

Step 11 Spoken answers

The researcher decided to complete the picture–based sentence construction before asking the participants to answer the questions verbally. This decision was taken, as spoken language is the more dominant and familiar mode and the researcher wanted to separate the two responses in an effort to minimize the effect of the verbal on the visual mode. For the same reason, the computer was switched off during the verbal sentence construction task. The same questions were asked and the participants were asked to give a spoken answer. Their responses were recorded.

3.8.4 Procedural integrity

Procedures were recorded and 20% of the data was rated for procedural integrity by an independent colleague. (See Appendix G for the procedural integrity forms). Tables 3.9 and 3.10 provide the percentages calculated for the training and testing procedures.

Table 3.9 Procedural integrity percentages for training procedure

	Group A	Group B	Group C	Group D
Percentages obtained for training procedure	100%	100%	100%	90%

Table 3.10 Procedural integrity percentages for testing procedure

	SVO exposures	SOV exposures
Percentages obtained	100%	100%

3.9. ANALYSIS OF DATA

3.9.1 Exclusion of responses

Twenty nine PCS answers had to be excluded because they were irrelevant. Tables 3.11 and 3.12 provide examples of excluded answers. These participants answered the questions incorrectly. After the exclusion of these responses, two hundred and five PCS responses remained to be analyzed. Ten of the excluded responses were made by the SVO input and nineteen of the excluded responses were made by the SOV input. There were three "no responses" in the spoken answers. Two hundred and thirty one spoken responses remained to be analyzed.

Table 3.11 Participant 19's responses to Question 1

Participant 19
Question 1 Where did the witch live? **Model answer** Witch lives castle.
Participant's responses
Selected Category: People
Selected Object John
Selected Object: Mary
Undid previous object
Undid previous object
Selected Category: People
Selected Object: Witch
Selected Category: Things
Selected Object: Castle
Selected Category: Actions
Selected Object: C: Apologize
Selected Object: Give
Undid previous object
Undid previous object
Selected Object: Give
Selected Object: Apologize
Undid previous object
Undid previous object
Selected Category: Things
Selected Object: Apple
Selected Category: Actions
Selected Object: Give
Selected Object: Apologize
Selected Object: Live

Table 3.12 Participant 37's responses to Question 2

Participant 37
Question 2 Where did John go? **Model answer** John go mountains.
Participant's response
Selected Category: People
Selected Object: Witch
Selected Category: Actions
Selected Object: Beat
Selected Object: Apologize
Selected Category: Actions
Selected Category: People
Selected Category: People
Selected Category: People
Selected Category: Things
Undid previous object
Undid previous object
Selected Object: Monkey
Selected Object: Chocolate
Selected Category: People
Selected Object: Apple Boy
Selected Category: Actions
Selected Object: Beat
Selected Object: Apologize

3.9.2 Analysis of output sequence

Each symbol was classified as subject (S), verb (V) or object (O). The responses were then classified into four types. The following responses are examples of Type 1 responses: "live castle", "Witch live castle", "give chocolate monkey" and "Apple Boy give monkey chocolate". Type 2 responses include responses like "castle live", "monkey chocolate give", "Witch castle live" as well as "Apple Boy chocolate monkey". The third type was the single symbol utterances and the fourth type was used for sentences that could not be categorized into any of these types.

3.9.3 Number of elements used

The number of elements that the subjects expressed with the picture-based communication system (PE) and the number of elements expressed verbally (VE) were calculated for all the subjects.

3.9.4 Changes made to the output

The number of changes made to the output sequence was presented in percentages. The changes made by the SVO and SOV inputs were compared.

3.10 STATISTICAL CALCULATIONS

3.10.1 Mann -Whitney U test

The Mann-Whitney U test, a nonparametric test, was used to determine whether there were significant differences between the SVO and SOV inputs. This test was used, because the data was not distributed normally (McMillan & Schumacher, 2001).

3.10.2 Chi-Square

Chi-Square is a statistical procedure that is used as an inferential statistic with nominal data (McMillan & Schumacher, 2001). This test was used to determine whether there were significant differences between the output sequences produced by the SVO and SOV inputs.

3.11 SUMMARY

Chapter 3 described the methodology of the study. It included the research question, a description of the pilot studies and the participants, the data collection and analysis procedures, as well as the material and equipment used.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter describes the results of the study. The discussion will commence with a description of the picture-based answers and will include the following: the general performance of the SVO and SOV inputs in terms of the output sequences used in the PCS answers; the number of PCS used and the changes made to the PCS responses; the PCS answers to specific questions; and a discussion of single symbol utterances. Finally, the output sequences used in spoken answers will be discussed.

4.2 PICTURE-BASED ANSWERS

4.2.1 The general performance of SVO and SOV inputs

The first aspect of the general performance of these inputs that should be looked at is the output sequences used. Table 4.1 provides an analysis of the output sequences used by the SVO and the SOV inputs.

Table 4.1 Analysis of the percentages of different PCS output sequences (SVO and SOV inputs)

Order of Output	***SVO input***	***SOV input***	***P-Value***
SVO	35% (n=41)	9% (n=7)	
SOV	2% (n=3)	5% (n=5)	
Single symbol answers	41% (n=47)	72% (n=65)	
Other	21% (n=24)	14% (n=13)	
Totals	100% (n=115)	100% (n=90)	0.0001*

* Significant on 1% level

The participants who received an SVO input had a total of 115 PCS sentences and the participants who received SOV only had 90. Forty one (35%) of the PCS answers given by the participants who received SVO input had an SVO order. Forty seven (41%) of the PCS answers given by the participants who received SVO input were single symbol answers and only three (2%) of the PCS answers had an SOV sequence. With the participants who received a SOV input a different pattern is evident. Sixty-five answers (72%) provided by the participants who received an SOV input were single symbols utterances, followed by thirteen answers (14%) that were classified as "Other" and seven answers (9%) had a SVO order. Only five PCS answers (5%) had a SOV order.

There are three key differences between the participants who received an SVO input and the participants who received an SOV input's performances. Thirty-five percent of the participants who received an SVO input's PCS utterances were classified as SVO whereas the participants who received an SOV input had only 9% SVO utterances. The participants who received an SOV input used more single symbol utterances than the participants who received an SVO input. Furthermore, the participants who received an SVO input produced more utterances that were classified as "Other". The Chi-Square test was done to determine whether these results (the differences in performance for the participants who received the SVO and SOV inputs) were significant. The test indicated that there were significant differences in the output sequences produced by the participants who received the SVO and SOV inputs and that any differences that occurred were not coincidental.

This data indicates that the participants who received SVO and SOV inputs used small percentages of SOV ordered outputs. Younger children imitatively learn the linguistic patterns for spoken language directly from adults' speech and will imitate ungrammatical sequences (Tomasello, 2001). Older children, such as the participants in this study, do not merely imitate the language input they receive. They learn individual elements and creatively combine these elements. These tendencies might also be evident in the case of picture-based communication. The participants who received SVO inputs as well as those who received SOV inputs used high percentages of single symbol utterances. This inhibition of expressive language could be caused by the graphic medium itself. Communicating with PCS is completely different to communicating with speech. The graphic medium does not facilitate the combination of constituents. It seems that the SOV input used less PCS in compiling their PCS responses. Although many reasons for this could be identified, it seems that the SOV input inhibited the expressive language skills of the participants. The participants were unsure and this caused them to use telegraphic communication.

The willingness of the participants who received an SVO input's to combine PCS resulted in more utterances that could be classified as either SVO or SOV ordered answers. However, as mentioned earlier, 21% of their answers could not be classified as either SVO or SOV ordered answers. Table 4.2 provides some examples of these "Other" utterances.

Table 4.2 Examples of utterances classified as "Other"

Participant	Question	PCS answer	Classification
17	2	River Mary go	OSV
28	1	Castle live witch	OVS
40	4	Monkey chocolate	OO
5	5	Beat witch Apple Boy	VOS
17	4	Chocolate monkey Give	OOV

Graphic representations are not articulated, but are selected from a predetermined array (Smith, 2004). This limits the manipulation of symbols or the changes that can be made to the output by the user. The current study gave the participants the option to delete unwanted symbols. The computer recorded all the symbols, even deleted ones.

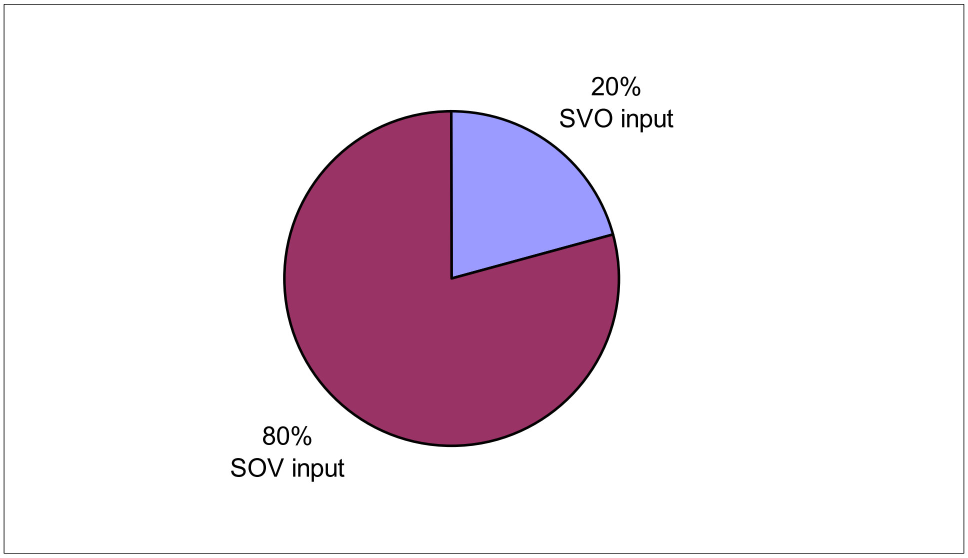


Figure 4.1 Total corrections made for all the responses (SVO and SOV inputs)

Figure 4.1 compares the total number of corrections made by the participants receiving the SVO input as well as the participants receiving an SOV input. The participants receiving an SVO input made 20% corrections to their PCS answers whereas the participants receiving an SOV group made 80% changes. It seems that the participants receiving an SOV input made considerably more corrections to their PCS answers. They had more difficulty in finding the correct symbols. The SOV input which did not place the parts of speech in the predictable order of Subject, Verb and then Object, confused these participants. This insecurity caused the unfamiliar SOV input to make more errors. Some participants followed the order of the input, but as they saw their answers on the computer deleted the symbols to change their answers to an SVO output. Participant 33's PCS answer to question 2 illustrates this and is given in Table 4.3.

Table 4.3 Log file of participant 33 (question 2)

Question 2 Where did John go? *Model answer John go mountains* **Participant 33's response** Selected category: People Selected object: John Selected category: Things Selected object: mountain Selected category: Actions Undid previous object Selected object: Go Selected category: Things Selected object: Mountain

This participant clicked on the People category and chose John. He then continued to choose Things and clicked on "mountain". He then selected Actions. This means that he has followed the SOV sequence, but he now "undid"/deleted "mountain" to first select the correct verb namely "go". He re-selects "mountain". This leads to PCS output sequence of SVO.

Table 4.4 Participant 34 (question 2)

Question 2 Where did John go? Model answer John go mountains **Participant 34's response** Selected Category: People Selected Object: John Selected Category: Things Selected Object: River Selected Object: River Undid previous object Undid previous object Selected Object: Mountain

Another type of correction was when the participants deleted their incorrect selections within a specific category. Table 4.4 presents the log file of participant 34's responses to question 2. He answered question 2: "Where did John go?" with "John River River" and then realized he had made an error and deleted the two objects and selected the correct object namely “mountain”.

Another important factor to consider is the number of symbols that the participants expressed with the picture-based communication system. Picture-element (PE) scores - the number of PCS that the participants expressed with the picture-based communication system were calculated for the SVO and SOV inputs.

Table 4.5 provides the mean and standard deviation PE-scores for the participants in this study.

Table 4.5 The mean ($\bar{X}$) and standard deviation (SD) PE –scores for the SVO and SOV inputs

SVO INPUT		***SOV INPUT***		
$\bar{X}$	**SD**	$\bar{X}$	**SD**	P-value
11,1	5,5	8,4	6,1	0.11

The participants receiving SOV input consistently used less PCS elements when answering the questions and had a slightly greater variation around the mean than the SVO input. The Mann-Whitney test was conducted to determine if the difference between the mean number of PCS used by the participants receiving SVO and SOV inputs was statistically significant. The test indicated that the difference is not statistically significant.

4.2.2 Analysis of specific questions

A closer look at the PCS answers to specific questions might provide us with more insight into the language learning experience of AAC users and picture-based sentence construction. Table 4.6 presents the mean, standard deviation PE-scores for the different questions.

Table 4.6 The mean ($\bar{X}$) and standard deviation (SD) PE scores for specific questions.

	Type of question	SVO		SOV		P-value
		$\bar{X}$	SD	$\bar{X}$	SD	
Question 1	Closed	1,8	0,9	1,7	1,3	0.52
Question 2	Closed	1,6	1,2	1,5	1,3	0.76
Question 3	Closed	2,1	0,9	1,8	1,5	0.15
Question 4	Closed	2,2	1,6	1,8	1,6	0.51
Question 5	Open	1,9	1,6	0,6	1,2	0.01*
Question 6	Open	1,4	1,2	0,6	1,2	0.05

*** Significant at 5% level**

This table confirmed that the participants receiving the SOV input consistently used less PCS when answering all 6 questions. The participants receiving the SVO and SOV inputs had very similar mean PE-scores for questions 1 and 2. The differences between the performances of the participants receiving the SVO and SOV inputs became greater from question 3 and are the largest at questions 5 and 6.

Questions serve a very useful purpose. It keeps communication going, can verify a child's meaning or it can simply obtain information (Manolson, 1984). Basil (1992) distinguished between closed and open questions. A closed question implies a simple choice of, for example, yes/no or a single word. Questions that lead to single word answers are appropriate at very early stages of development when children have a limited vocabulary, but they may be limiting when children can string words together in a sentence (Manolson, 1984). A closed question gives information about structures to include in the answer. When answering question 1: "Where did the witch live?" the participants knew that their sentence should start with "The witch lived…." Open questions give less information about how the answer should be structured. Harris, Doyle and Haaf (1996) explained that language input should encourage analytical skills in order to elicit complex language. Open-ended questions elicit longer sentences (Manolson, 1984) and encourage analytical sentence construction, but require more effort and seem to be more complex. The participants have to analyze their answers into their individual symbols in order to build a PCS sentence.

There was a significant difference between the PE-scores of the participants receiving the SVO and SOV inputs for question 5. The current study had four closed questions and two open questions. This could imply that the inhibiting effect of the SOV input could have been more prominent for open questions if the study had included more open questions.

4.2.3 Single symbol utterances

Nakamura *et al,* (1998), Sutton and Morford (1998) and Udwin and Yule (1990) observe the frequent use of single symbol utterances. Although the participants in this study were taught to and specifically instructed to answer questions with full PCS sentences, the SVO and SOV inputs produced numerous single symbol answers.

It is interesting that the participants responded with "whole" PCS answers even though their verbal responses were more extensive. Table 4.7 provides some examples of what Smith (1988) labelled as global utterances. It seems that all the information needed to answer a question was conveyed in a single PCS even though these participants had all the PCS available to construct multi-term utterances. In this global approach PCS is perceived as "wholes" and not as components of an ordered sequence (Smith, 1996).

Table 4.7: Examples of global utterances

Questions	Participant	PCS answers	Spoken utterances
2	9	Mountains	He went to the mountains.
5	29	Beat	She beat the witch
6	5	Apologized	The witch apologized to the village people

Another interpretation of this tendency is that in aided communication the meaning of communication is co-constructed by the user and his communication partner (Soto, 1999). The communication partner labels the graphic signs indicated by the aided user and clarifies selections. This leads to a series of single symbol utterances. Harris *et al* (1996) warned that single symbol utterances might meet basic communication needs, but can change the nature of language learning experiences or even hinder some aspects of it.

4.3 SPOKEN ANSWERS

4.3.1 The output sequence for the spoken answers

Table 4.8: Analysis of the percentages of different spoken output sequences (SVO and SOV inputs)

Order of Output	*SVO input*	*SOV input*	*P-value*
SVO	45% (n=53)	42% (n=48)	
SOV	---------------	---------------	
Single symbol answers	55% (n=65)	58% (n=65)	
Totals	100% (n=118)	100% (n=113)	0.57

Table 4.8 classifies the speech output sequences given by the participants receiving SVO and SOV inputs. The participants receiving SVO input had a total of 118 spoken

sentences and the participants receiving SOV had 113. Fifty-three (45%) of the spoken answers given by the participants receiving SVO input had an SVO order. Sixty-five (55%) of the spoken answers given by the participants receiving SVO input were single symbol answers. The participants receiving the SOV input had a very similar performance pattern. Sixty-five (58%) of the spoken answers given by the participants receiving an SOV input were single symbol utterances. Forty-eight (42%) of the spoken answers given by the participants receiving the SOV input were SVO output sequences. These participants used no SOV ordered outputs. The Fisher –exact test were conducted to see whether there were significant differences between the participants receiving the SVO and the SOV inputs spoken answers. The test indicated no significant difference between the two groups' performances. The SOV input did not influence the sequence of the participant's spoken answers. The participants had normal language abilities. This could indicate that PCS and speech is relatively independent if the child with normal language abilities has to provide a spoken output. In this study, however, this does not hold true when the output is PCS. These children are speaking and spoken language is familiar to them. When asked to provide PCS output, they had to recode their answers from a spoken medium to a relatively unfamiliar graphic medium.

The question is raised how participants would respond to unfamiliar visual input. Smith & Grove, 2003) reported that individuals with the ability to hear use spoken language input to develop receptive language. Spoken receptive language provides a basis for expressive language (Smith & Grove, 2003). These individuals recode speech into available lexical items at the point of expression. The non-speech communicator's internal lexical representations may be bi-modal. This could lead to the formulation of bi- or multi-modal utterances and implies a more complex process.

4.4 CONCLUSIONS

Although the participants in this study were novices at picture-based sentence construction they did not sequence their output to match the word order of an SOV input. These children‘s language base had already been established. Akhtar (2001) proposes that older children analyze language input in order to form syntactic templates. Sufficient data must then be acquired to be able to formulate syntactic categories. The SOV condition used less PCS elements than the SVO condition. The ungrammatical SOV input had an inhibiting effect on language use. Overall it leads to less output and the production of predominantly single symbol utterances. The inhibiting effect of the SOV input is more prominent for open questions. Open questions encourage analytical sentence construction and lead to longer sentences.

The SOV input did not influence the sequence of the participant’s spoken answers. The participants had normal language abilities. The SVO and SOV’s groups gave similar spoken answers.

CHAPTER 5
SUMMARY AND CONCLUSION

5.1 INTRODUCTION

Chapter 5 summarizes and integrates the findings of this study. The study is critically evaluated and recommendations for further research are discussed.

5.2 SUMMARY

The aim of this study was to investigate the impact of visual sequencing of pictures on the picture-based sentence construction of Grade 2 English-speaking children. Participants were randomly assigned to two comparable groups and exposed to two input sequences to investigate the impact of each input on PCS sentence construction. In the SVO input the symbol order was in the normal English word order sequence (Subject-Verb-Object) and in the SOV input the symbol order was Subject-Object- Verb. The participants were trained as a group. The training included teaching of the categorization process needed to select a PCS symbol, practising the combination of PCS into sentences and listening to a story. Each child then individually answered 6 questions about this story by firstly combining PCS into sentences and then answering these same questions verbally.

The "Apple Boy story" and the set of questions (Nakamura *et al*, 1996) were adapted for Grade 2 children. The picture-based communication system was developed on a personal computer (PC) using the picture communication system construction package Boardmaker (Mayer-Johnson^{TM} Co) and the programming language Visual Basic. The computer recorded the participant's responses, including deleted symbols.

Each symbol in the PCS and spoken output was classified as subject (S), verb (V) or object (O). The symbol order was analyzed and the responses were classified into four types. The first type included VO, VOO, SVO and SVOO. The second type included OV, OOV, SOV and SOOV. The third type included single symbol utterances and the fourth type was used for responses that could not be classified into any of these types. The number of elements used in each sentence was calculated.

The participants in this study did not sequence their output to match the SOV input. The participants receiving the SVO and SOV inputs used predominantly single symbol responses. The participants receiving the SOV input used significantly fewer PCS than the participants receiving the SVO input. It seemed that the SOV input might have had an inhibiting effect on the quantity of the participants' outputs. The participants receiving the SOV input experienced more difficulty to find the correct symbol and changed their outputs more than the SVO input.

5.3 CRITICAL EVALUATION OF THIS STUDY

5.3.1 The use of typically developing children

The participants were typically developing children. The use of typically developing children makes it more difficult to generalize findings to children with disabilities (Higginbotham, 1995). The use of typically developing children can, however, facilitate the understanding of normal development and this knowledge can be used as a basis for understanding children with disabilities. Children with severe physical impairments have atypical language profiles. The normal developmental model needs to be used in conjunction with alternative models (Gerber & Kraat, 1992).

Higginbotham and Bedrosian (1995) maintained that the research question and methodology should determine which participants must be selected and not the disability status of the participants. This is a quasi-experimental design. The relationship between graphic input and the linguistic output is explored. Consistency of performance is needed to control for intra/inter-subject variables. Since little is known about the impact of graphic input on language output, the use of typical children allows the examination of this aspect before examining the added impact of factors such as physical or intellectual handicaps in the performance of the same tasks.

5.3.2 Sample size

McMillan and Schumacher (2001) proposed at least fifteen participants in a group to enable comparison of groups. This study met the criteria. As the current study was exploratory a smaller sample size is still acceptable. Nakamura *et al* (1996) used approximately the same sample size and Smith (1996) used an even smaller sample size when she discussed speaking children's use of communication boards. All the participants came from the same school and the same socio-economic environment. The participants could therefore not be seen as representative of South African children. This aspect obviously limits the potential for generalization.

5.3.3 Material used in this study

5.3.3.1 The story

This study adapted the story used by Nakamura *et al* (1996) and included eight story illustrations. Predictable discourse contexts such as stories have been shown to elicit complex language from both the child and the caregiver (Harris *et al*. 1996). In this study, most of the utterances were classified as single symbol utterances.

5.3.3.2 The questions

In this study 4 closed questions and 2 open questions were used. There was a significant difference between the PE-scores of the SOV and SVO conditions for question 5. The inhibiting effect of the ungrammatical input could have been more prominent for open questions if the study had included more open questions. Future research must incorporate more open questions to confirm whether the inhibiting effect of the ungrammatical input on these questions.

5.3.3.3 Evaluation of the picture-based communication software

The software proved to be very useful for the purposes of this study. The participants could successfully build PCS sentences. They enjoyed working on the computer and were proud of their efforts. As mentioned earlier, the picture- based communication system was developed on a personal computer (PC) using the picture communication system construction package Boardmaker (Mayer-Johnson™ Co.) and the software program Visual Basic. The researcher assisted in the designing process. The program was edited as a result of Pilot study 2 (See Chapter 3) and in response to recommendations made by colleagues. The software is very user-friendly. It is instruction- driven. Every step in the process was clearly explained by audio instructions and visual prompts. Furthermore, the program included a training module. All the responses were logged to assist with analysis. The participants could delete unwanted symbols.

The selection of vocabulary included in a communication system can influence the construction of PCS sentences (Paul, 1997). The current study included PCS symbols for the basic parts of speech, namely Subject, Verb and Object in order to encourage grammatically correct sentences. Additional parts of speech e.g. prepositions and ading symbols to indicate the future and past tenses could lead to more complete sentences.

5.3.4 **Procedural integrity**

It is important to ensure that the difference in outputs is a consequence of the presentation of the graphic input and not because of any other variables. Procedures were recorded and 20% of the data was rated for procedural integrity by an independent rater. High percentages of procedural integrity indicated that the researcher was consistent in following the procedures across participants.

5.4 IMPLICATIONS FOR FURTHER RESEARCH

This study included only two open questions. Further research needs to be conducted to determine the impact of visual language input on children's responses to different types of questions, specifically open questions. Nakamura *et al* (1996) studied the picture-based sentence construction of English- and Japanese- speaking adults. It would be interesting to investigate the impact of visual language input on African languages.

Research with a single subject approach with AAC users can be used to explore the impact of different input sequences on the output of people with disabilities. The same procedures can be used to facilitate the comparison of the results obtained with typically developing children to the results obtained with AAC users.

REFERENCES

Akhtar, N. (2001). Acquiring basic word order: Evidence for data-driven learning of syntactic structure. In M. Tomasello & E Bates (eds.).*Language development: The essential readings* (pp 187-202). Blackwell Publishers: Oxford.

Basil, C. (1992). Social interactions and learned helplessness in severely disabled children. *Augmentative and Alternative Communication,* 8(3), 188-192.

Behr, A.L. (1971). *A textbook of educational method.* Pretoria: J.L Van Schaik Ltd.

Blockberger, S., & Sutton, A. (2003). Toward linguistic competence: Language experiences and knowledge of children with extremely limited speech. In J. Light & D. Beukelman & J. Reichle (Eds.), *Communicative competence for individuals who use AAC.* London: Paul H Brookes.

Bloom, L. (1998). Language acquisition in its developmental context. In D Kuhn & R Siegler (Eds.), *Cognition, perception, and language. Volume 2 of the handbook of child psychology (5th ed.)*, Editor-in-Chief: William Damon. New York: Wiley.

Boardmaker [Computer software]. (2001). Solana Beach, CA: Mayer-Johnson Co.

Brekke, K.M., & Von Tetzchner, S. (2003). Co-construction in graphic language development. In S. Von Tetzchner & N. Grove (eds.). *Augmentative and Alternative Communication: Developmental issues.* (pp. 176-210) Whurr Publisher: London.

Burd, L., Hammes, K., Bornhoeft, D., Fisher, W. (1988). A North Dakota prevalence study of non-verbal school- age children. *Language, Speech and Hearing Services in Schools,* 19(4), 371-373.

Chomsky, N. (1965). *Aspects of the theory of syntax.* Cambridge: MA MIT Press

Fitzgerald, E. (1949). *Talking to the deaf: A system of instruction for deaf children.* Washington, D.C: The Volta Bureau.

Gandell, T., & Sutton, A. (1998). Comparison of AAC interaction patterns in face- to-face and telecommunications conversations. *Augmentative and Alternative Communication, 14(1), 3-10.*

Gerber, S. & Kraat, A. (1992). Use of a developmental model of language acquisition: Applications to children using AAC. *Augmentative and Alternative Communication,* 8, p 19-32.

Gibson, E.J. (1967). *Principles of perceptual learning and development.* New York: Appleton-Century-Crofts.

Harris, L., Doyle, E., & Haaf, P. (1996). Language treatment approach for users of AAC: Experimental single-subject investigation. *Augmentative and Alternative Communication, 12(4),* 230-243.

Hawkins, J.M. (1988). *The Oxford Paperback Dictionary.* Oxford: Oxford University Press.

Hemmeter, M.L., & Kaiser, A.P. (1994). Enhanced milieu teaching: Effects of parent-implemented language intervention. *Journal of Early Intervention,* 17(1), 85-99.

Higginbotham, D.J. (1995). Use of non-disabled subjects in AAC research: Confessions of a research infidel. *Augmentative and Alternative Communication,* 11 (1), 2-5.

Higginbotham, D.J., & Bedrosian, J.L. (1995). Subject selection in AAC research: Decision points. *Augmentative and Alternative Communication,* 11 (1), 11-13.

Hoff-Ginsberg, E. & Shatz, M. (1982). Linguistic input and the child's acquisition of language. *Psychological bulletin*, 3-26.

Johnson, R. (1981). *The Picture Communication Symbols, Book 1*. Solana Beach, CA: Mayer-Johnson.

Johnson, R. (1985). *The Picture Communication Symbols, Book II*. Solana Beach, CA: Mayer-Johnson.

Johnson, R. (1992). *The Picture Communication Symbols, Book III*. Solana Beach, CA: Mayer-Johnson.

Lee. L., L. (1969). *The Northwestern Syntax Screening Test*. Northwestern University Press.

Light, J. (1988). Interaction involving individuals using AAC systems: State of the art and Future direction. *Augmentative and Alternative Communication,* 4(2), 66-82.

Light, J. (1989). Towards a definition of communication competence for individuals using Augmentative and Alternative Communication systems. *Augmentative and Alternative Communication,* 5(2), 137-144.

Light, J. (1997). Let's go starfishing: Reflections on the context of language learning for children who use AAC. *Augmentative and Alternative Communication*, 13, 158-171.

Light, J., Drager, K., McCarthy, J. *et al.* (2004). Performance of typically developing four-and five-year-old children with AAC systems using different language organization techniques. *Augmentative and Alternative Communication,* 20 (2). 63-88.

Light, J., Kelford, Smith, A. (1993). Home literacy experiences of pre-schoolers who use AAC systems and of their non-disabled peers. *Augmentative and Alternative Communication,* 9, 10-25.

Light, J., & Lindsay, P. (1991). Cognitive Science and Augmentative and Alternative Communication. *Augmentative and Alternative Communication,* 7(3), 186-203.

Lloyd, L.L., Fuller, D.R., & Arvidson, H.H. (1997). *Augmentative and alternative communication: A handbook of principles and practices.* Massachusetts: Allyn & Bacon.

McMillan, J.H., & Schumacher, S. (2001). *Research in Education: A conceptual introduction.* New York: Addison Wesley Longman, Inc.

Manolson, A. (1985). *It takes two to talk: A Hanen early language parent book.* Toronto: Hanen Early Language Resource Centre.

Miller, N. (editor). (1984). *Bilingualism and Language Disablity: Assessment and Remediation.* London and Sydney: Croom Helm.

Nakamura, K., Newell, A.F., Alm, N. & Waller, A. (1996). How do members of different language communities compose sentences with a picture-based communication system? - A cross-cultural study of picture-based sentences constructed by English and Japanese speakers. *Augmentative and Alternative Communication,* 14, 71-79.

Oxley, J.D., & Norris, J.A. (2000). Children's use of memory strategies: Relevance to voice output communication aid use. *Augmentative and Alternative Communication,* 16, 79-94.

Paul, R. (1997). Facilitating transitions in language development for children using AAC. *Augmentative and Alternative Communication.* 13, 141-147.

Pinker, S. (1984). *Language learnability and language development.* Massachutes: Harvard University Press.

Rokoff, B. (1998). Cognition as a collaborative process. In D Kuhn & R Siegler (Eds.), *Cognition, perception, and language. Volume 2 of the handbook of child psychology (5th ed.)*, Editor-in-Chief: William Damon. New York: Wiley.

Romsky, M., & Sevcik, R.A. (2003). Augmented Input: Enhancing communication development. In J. Light & D. Beukelman & J. Reichle (Eds.), *Communicative competence for individuals who use AAC.* London: Paul H Brookes.

Smith, M.M. (1996). The medium or the message: A study of speaking children using communication boards. In S. Von Tetzchner & M.G. Jensen (eds.). Augmentative and Alternative Communication European Perspectives (pp137-152). Whurr Publishers: London.

Smith, M.M. (2004, February). *Speech, language and aided communication: Connections and questions in a developmental context.* Presentation at the Research Symposium organized by the Center for Augmentative and Alternative Communication, Pretoria, South Africa.

Smith, M., & Grove, N. (2003). Asymmetry in input and output. In J. Light & D. Beukelman & J. Reichle (Eds.), *Communicative competence for individuals who use AAC* (pp 163-198). London: Paul H Brookes.

Soto, G. (1999). Understanding the impact of graphic sign use on the message structure. In F.T. Loncke, J Clibbens, H.H. Arvidson & L.L Lloyd (eds.). *Augmentative and*

Alternative Communication, New directions in research and practice. (pp. 31-39). Whurr Publishers: London.

Soto, G., & Toro-Zambrana, W. (1995). Investigating of Bliss symbol use from a language paradigm. *Augmentative and Alternative Communication,* 11, 118-128.

Stehpenson, J., & Linfoot, K. (1996). Pictures as communication symbols for students with severe intellectual disability. *Augmentative and Alternative Communication,* 12 (4), 244-255.

Sutton, A. & Morford, J. (1998). Constituent order in picture pointing sequences produced by speaking children using AAC. *Applied Psycholinguistics,* 19, 525-536.

Tomasello, M. (2001). The item-based nature of children's early syntactic development. In M. Tomasello & E Bates (eds.).*Language development The essential readings* (pp 169-186). Blackwell Publishers: Oxford.

Udwin, O., & Yule, W. (1990**).** Augmentative communication systems taught to cerebral palsied children – a longitudinal study. I The acquisition of signs and symbols, and syntactic aspects of their use over time. *British Journal of Disorders of Communication.* 25, 295-309.

Von Tetzchner, S., Grove, N., Loncke, F., Barnett, S., Woll, B. & Clibbens, J. (1996). Preliminaries to a comprehensive model of augmentative and alternative communication. In S. von Tetzchner & M.H. Jensen (eds.). *Augmentative and Alternative Communication: European Perspectives* (pp1-19). London: Whurr Publishers.

Von Tetzchner, S., & Martinsen, H. (1996). Words and strategies: Conversations with young children who use aided language. In S. Von Tetzchner & M.G. Jensen (eds.). *Augmentative and Alternative Communication: European Perspectives.* Whurr publishers: London.

Vygotski, L. (1978). *Thought and Language.* Cambridge, Masshachusetts: Harvard University Press.

Wadsworth, B.J. (1989). *Piaget's theory of cognitive and affective development.* New York & London: Longman Group Ltd.

APPENDIX A: Permission letters

246 Selborne Avenue
Centurion
0157
Telephone number (012) 664 3055
Cellular number 072 1405644

22 April 2003

Mr Charles,

Re: Permission to conduct a research study at St Paulus

I am a Masters student at the Centre for Augmentative and Alternative Communication (CAAC) at the University of Pretoria. This centre addresses the needs of people with complex communication needs. I am at present conducting research into the picture- based sentence construction of Grade 2 English- speaking children.

The research will involve the following:

- Pilot study with approximately 10 children to evaluate my research procedures and to determine the suitability of my material.
- The main study will involve 40 participants and will include:
  - a) Training of children in 4 groups (30 minutes)
  - b) Individual work to answer questions on the computer. (10 minutes per child)

The results of this study will be available to you upon request.

Please contact me if you need any additional information.

Thank you

____

AMELIA DU PLOOY

Dear Parent,

<u>Re: Permission for participation in research study</u>

I am a Masters student at the Centre for Augmentative and Alternative Communication (CAAC) at the University of Pretoria. I am conducting research into the picture – based sentence construction of Grade 2 children. This research will be conducted at St Paulus.

I would like to include ___________________ as a participant in the pilot study. All information obtained will be handled confidentially and will be used only for the purposes of this study. Results of the study will be available to you upon request.

Could you kindly complete and return this form by 10 May 2003 should permission be granted.

Thank you for your support.

____

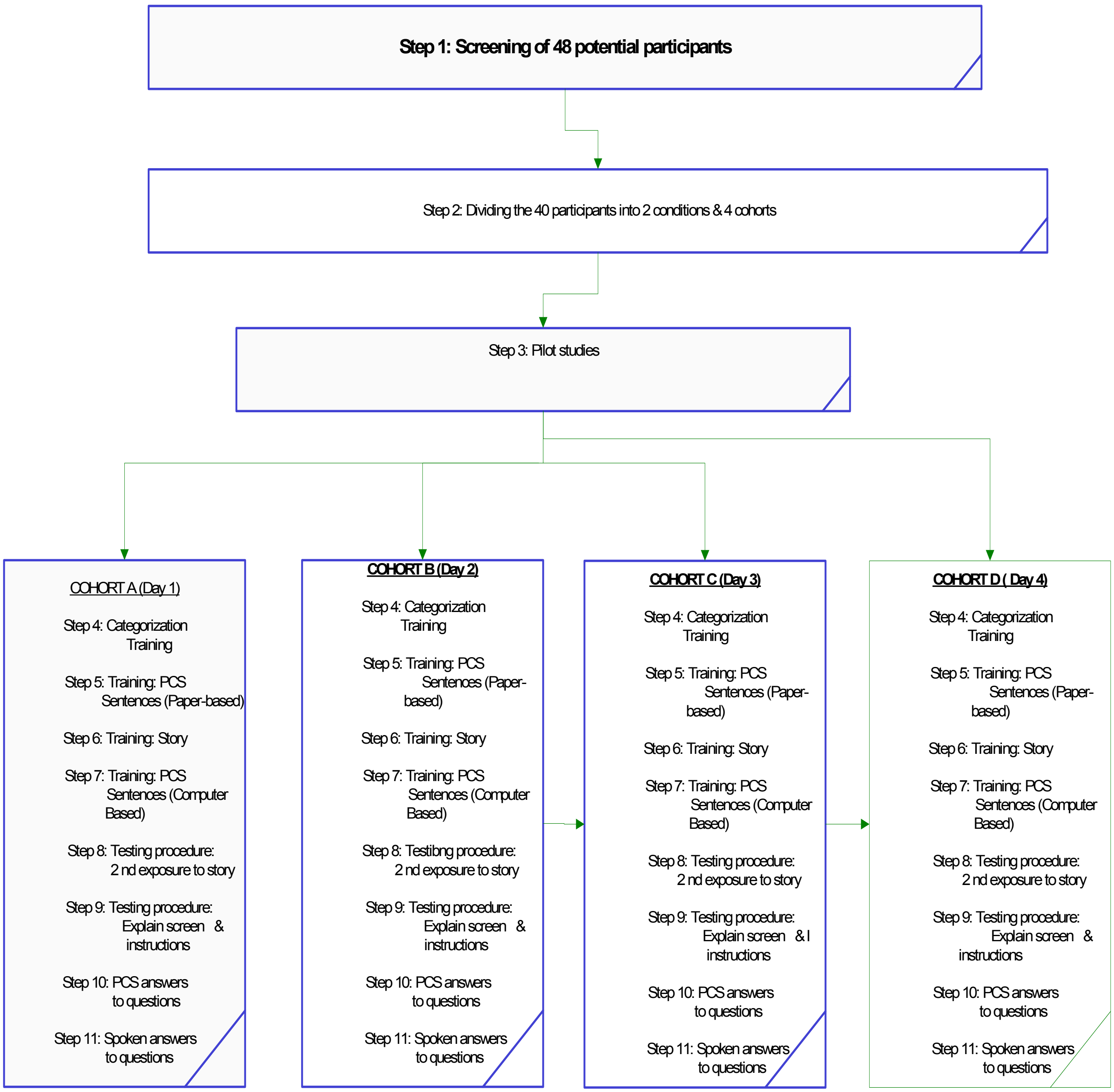
AMELIA DU PLOOY

I ________________________________(guardian/parent's name) hereby grant permission

that______________________________ (child's name) may participate in this study.

Date:_______________________________________

APPENDIX B : FLOWCHART



APPENDIX C: Story and questions

Original Story of the Apple Boy

A married couple, John and Mary, were living in a village. Sometimes, a witch who lived in a castle came to the village in order to rob the people of their money. One day, John went to the mountain and Mary went to the river. When Mary was washing their clothes in the river, a big apple floated towards Mary. Mary picked it up and took it home. As she arrived, a baby was born from the apple. The couple named the baby Apple Boy and fostered him. When the Apple Boy grew up, he decided to challenge the witch. On the way to the castle, the Apple Boy met a monkey and gave a chocolate to it. The monkey was so pleased that it promised to help the Apple Boy to challenge the witch. With the cooperation of the monkey, the Apple Boy could beat the witch. The witch was then forced to apologize to the village people.
(Nakamura, Newell, Alm & Waller, 1996)

Adapted version

John and Mary were living in a village. Sometimes, a witch who lived in the castle came to the village to steal the people's money. One day, John went to the mountain and Mary went to the river. When Mary was washing their clothes in the river, a big apple floated towards Mary. Mary picked it up and took it home. A baby was born from the apple. John and Mary named the baby Apple Boy. They loved him very much and took good care of him. When the Apple Boy grew up, he decided to fight the witch. On the way to the castle, the Apple Boy met a monkey and gave a chocolate to it. The monkey was so pleased that it promised to help the Apple Boy fight the witch. With the help of the monkey, the Apple Boy beat the witch. The witch was then forced to apologize to the village people.

Original questions

1. Where did the witch live?
2. Where did John and Mary go, respectively?
3. On the way to the castle, what did the Apple Boy give and to whom?

4. What was the result of the challenge between the Apple Boy and the witch?
5. What did the witch finally do?

Adapted questions

1. Where did the witch live?
2. Where did John go?
3. Where did Mary go?
4. What did the Apple Boy give and to whom?
5. The Apple Boy and the witch had a big fight. What happened?
6. What did the witch finally do?

APPENDIX D: Example of Log file

Start of Logging the Session for: EXAMPLE 2

First Question: Where Did John Go
Selected Category: People
Selected Object: Witch
Selected Category: Things
Selected Object: Castle
Selected Next Sentence.
Selected Category: People
Selected Object: Mary
Undid previous object
Selected Object: John
Selected Category: Things
Selected Object: Chocolate
Undid previous object
Selected Object: Mountain
Selected Next Sentence.
Selected Category: People
Selected Object: Mary
Selected Category: Things
Selected Object: River
Selected Next Sentence.
Selected Category: People
Selected Object: Apple Boy
Selected Category: Things
Selected Object: Chocolate
Selected Object: Monkey
Selected Next Sentence.
Selected Category: People
Selected Object: Witch
Selected Category: Actions
Selected Object: Live
Undid previous object
Selected Category: Actions
Selected Object: Apologize
Selected Next Sentence

Appendix E: Verbatim script

Training: Introduction

We are going to build sentences with pictures. You can use these sentences to talk to people who cannot hear. If you talk to these people they may not understand you, because they cannot hear you. They will be able to see what you want to tell them if you show them pictures of what you want to say.

Training: Categorization of PCS

We placed the pictures that belong together on the same card. We are going to use 3 cards today: People, Actions and Things.

This is my People card. Can you see the picture on the front of the card? All of these faces (pointing to PCS for people) stand for people. This is my Actions card. Actions are doing words. The picture on the front (pointing to PCS for actions) shows you that it is people doing things. My Things card has pictures of a few things like a pencil and an apple on the front. Things are not people and they are not actions. Look around you: What things do you see in this room?

If I turn my cards around you will see that we placed the pictures that belong together on the same card.

Girl and boy are on the people card.
Drink, eat and read are on the actions card.
Apple, water and book are on the things card.

These are your People, Actions and Things cards (researcher gives each child its own cards). Here are your pictures. Let's put them on the right cards.

-A boy (showing the PCS symbol) is a person. Put it at the back of your People card.

-Eat (showing the PCS symbol) is an action . Put it at the back of your Action card.

-A girl (showing the PCS symbol) is a person. Put it at the back of your People card.

-An apple (showing the PCS symbol) is a thing. Put it at the back of your Things card.

-Water (showing the PCS symbol) is a thing. Put it at the back of your Things card.

-Read (showing the PCS symbol) is an action . Put it at the back of your Action card

-Drink (showing the PCS symbol) is an action. Put it at the back of your Action card.

-A book (showing the PCS symbol) is a thing. Put it at the back of your Things - card.

Training: PCS sentence building (paper-based)

I want you to turn the cards around so that you only see the name of the card. You must not see the pictures that we placed there right now. Put them just like I placed mine: People, Actions and then Things.

Are you ready? Let's build the sentence "Boy reads book". We have to find pictures for the words boy, reads and book. Which word must we start with?

Boy?

Boy is a--------?

Person. Look at the back of your People card. Find boy. Place it in front of you.

What must we do next?

Reads

Read is an action. Look at the back of your Actions card. Take read and place it next to boy.

Book is a thing. Look at the back of your Things card. Take book and place it in front of you. Are you finished? Let's read your sentence: Boy read book.

The next sentence is: Boy drink water

Which picture do you want to start with?
Boy is a person. Look at the back of your people card. Take boy and put it in front of you.

Water is a thing. Look at the back of your Things card. Take the picture of water and put it in front of you.

Drink is an action. Look at the back of your Action card. Take the picture of drink and put it in front of you. Are you finished? Let's read your sentence. Boy water drink.

Put your cards just like I place mine: People, Things and Actions. Remember you must not see the pictures at the back.

I want you to build the sentence "Girl reads book" on your own. (Researcher checks the participants' sentences and assists the children who need help.

Now you can build the sentence "Girl eat apple". (Researcher checks the participants' sentences and assists children who need help.)

Training: Story

I am going to tell you a story about a boy. Please listen carefully. Try hard to remember, because you will have to answer some questions about this story."

(Oxley and Norris (2000) stated that children do best when they are told to "try hard" to memorize materials.)

Researcher reads the story to the children (See Appendix C)

Training: Building PCS sentences (computer –based)

We practised building sentences with pictures. Now we are going to try to do that on the computer.

These are the people, actions and things buttons. If you click on them you will see the different People, Actions and Things pictures you can use to build picture sentences.
Look at the screen. This is where you can listen to the sentence. These are the People, Actions and Things buttons. If you click on, for example, People, the options are boy and girl. You click on a picture and the computer will put it in this block (sentence construction area). That is where you will build the sentence.

The little face on the screen will tell you where you are. If you make a mistake you can erase it with this button. When you are finished with a sentence you must click on this picture. Do you understand? Take as long as you need to build the sentences. I will type your name here and then we are ready to start.

Second exposure to story

The computer will tell the Apple Boy story again, because it will help you to remember all the information in the story. Please try hard to remember. You are going to answer some questions about this story on the computer.

PCS answers to questions (computer-based)

You must answer the questions with these buttons. If you click on the People button, you will see all the people in the story. The people in the story are: John, Mary, Witch, Village people and Apple Boy. The actions are give, apologize, beat, live and go. The things are castle, river, apple, mountain, apple, chocolate and monkey. You must answer these questions with picture sentences. Build a sentence with these pictures.

This is where you listen to the question. Just click on the button if you want to listen to the question again. If you want to delete a picture, click on this button. You must click on this button when you have finished a question. Do you have any questions? Let’s start.

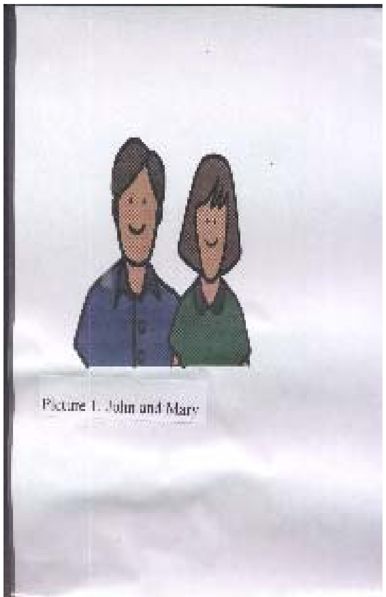
Spoken answers

We have finished with the computer. I am going to ask you the same questions, but this time you must give me the answer. You don’t have to use the computer and the pictures. You can just give me the answers.

End of session

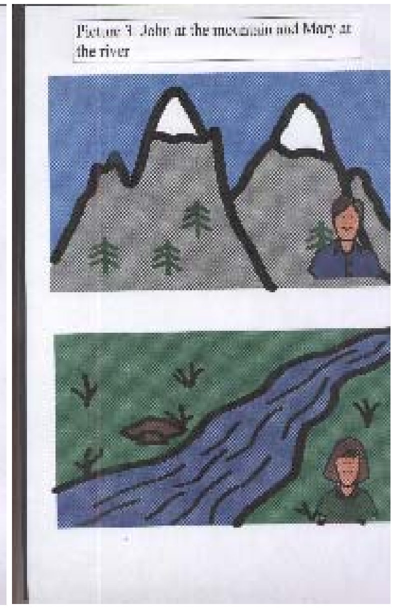
Thank you. You worked well today.

Appendix F Story illustrations



Picture 1: John and Mary

Picture 2: The witch and her castle



Picture 3: John at the mountain and Mary at the river

Picture 4: Mary washes clothes at the river.

Picture 5: A baby was born from the apple

Picture 7: The fight

Picture 8: The witch apologizes

Appendix G Procedural integrity forms

Table 1 Procedural Integrity for four cohorts

Steps	Group A	Group B	Group C	Group D
1. Introduce and explain communicating with pictures	√ √	√	√	√
2. Explain categorization of PCS	√ √	√	√	√
3. Introduce and explain People, Actions and Things charts	√ √	√	√	√
4. Sorting of PCS	√ √	√	√	√
5. Explain PCS sentence building	√ √	√	√	√
6. Placement of cards in order People, Actions and Things	√ √	√	√	√
7. Building sentences 1& 2	√ √	√	√	√
8. Placement of cards in order People, Things and Actions.	√ √		√	X
9. Building sentences 3&4	√ √	√	√	√
10. Instructions for first exposure to "Apple Boy" story.	√ √	√	√	√
11 Listening to story.	√ √	√	√	√

√ =Rating by researcher √ = Rating by independent colleague

Table 2 Procedural integrity form for SVO exposures

	P1	P2	P3	P5	P10	P11	P13	P16	P18	P20	P21	P22	P24	P26	P28	P32	P35	P36	P39	P40
1 Instructions for building sentences on computer.	√√	√	√ √	√√	√	√	√	√	√√	√√	√	√	√	√	√	√	√	√	√	√
2. Building 4 PCS sentences on the computer.	√√	√	√√	√√	√	√	√	√	√√	√√	√	√	√	√	√	√	√	√	√	√
3. Instructions for 2nd exposure to "Apple Boy" story.	√√	√	√√	√√	√	√	√	√	√√	√√	√	√	√	√	√	√	√	√	√	√
4. Listening to story.	√√	√	√√	√√	√	√	√	√	√√	√√	√	√	√	√	√	√	√	√	√	√
5. Point to People, Actions and Things Categories and their symbols on the screen.	√√	√	√√	√√	√	√	√	√	√√	√√	√	√	√	√	√	√	√	√	√	√

6. Instructions for answering questions with PCS.	√√	√	√√	√√	√	√	√	√	√√	√√	√	√	√	√	√	√	√	√	√	√
7. PCS answers to six questions.	√√	√	√√	√√	√	√	√	√	√√	√√	√	√	√	√	√	√	√	√	√	√
8.Instructions for spoken answers.	√√	√	√√	√√	√	√	√	√	√√	√√	√	√	√	√	√	√	√	√	√	√
9. Spoken answers.	√√	√	√√	√√	√	√	√	√	√√	√√	√	√	√	√	√	√	√	√	√	√

√ =Rating by researcher
√ = Rating by independent colleague

Table 3 Procedural integrity form for SOV exposures

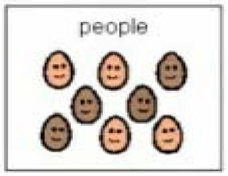
	P4	P6	P7	P8	P9	P14	P15	P17	P19	P23	P25	P27	P29	P30	P31	P33	P34	P37	P38
1 Instructions for building sentences on computer.	√√	√	√	√	√	√	√	√	√	√	√√	√√	√√	√	√	√	√	√	√√
2. Building 4 PCS sentences on the computer.	√√	√	√	√	√	√	√	√	√	√	√√	√√	√√	√	√	√	√	√	√√
3. Instructions for 2nd exposure to "Apple Boy" story.	√√	√	√	√	√	√	√	√	√	√	√√	√√	√√	√	√	√	√	√	√√
4. Listening to story.	√√	√	√	√	√	√	√	√	√	√	√√	√√	√√	√	√	√	√	√	√√
5. Point to People, Actions and Things Categories and their symbols on the screen.	√√	√	√	√	√	√	√	√	√	√	√√	√√	√√	√	√	√	√	√	√√
6. Instructions for	√√	√	√	√	√	√	√	√	√	√	√√	√√	√√	√	√	√	√	√	√√

answering questions with PCS.																			
7. PCS answers to six questions.	√√	√	√	√	√	√	√	√	√	√	√√	√√	√√	√	√	√	√	√	√√
8.Instructions for spoken answers.	√√	√	√	√	√	√	√	√	√	√	√√	√√	√√	√	√	√	√	√	√√
9. Spoken answers.	√√	√	√	√	√	√	√	√	√	√	√√	√√	√√	√	√	√	√	√	√√

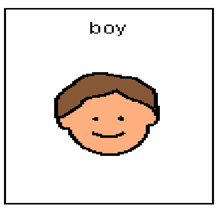
√ =Rating by researcher
√ = Rating by independent colleague

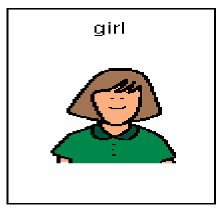
Appendix H: People, Actions and Things cards

People chart: Front

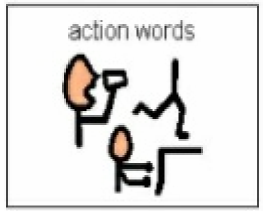


People chart: Back



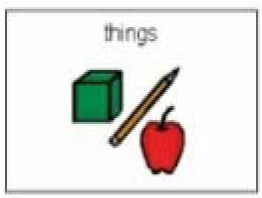


Action card: Front



Action card: Back

Things card: Front



Things card: Back