THE ICONICITY OF SELECTED PICTURE COMMUNICATION SYMBOLS FOR RURAL ZULU-SPEAKING CHILDREN

by

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Unless the Lord builds the house, its builders labour in vain…

Ps 127:1

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Summary

The existence of cross-cultural differences in the perception of pictorial material has long been established and documented. As the majority of graphic representational systems most frequently used for augmentative and alternative communication (AAC) is of a pictorial nature, the possibility of such differences impacting on the use of these symbol systems cannot be ignored. Knowledge about the nature and degree of such impact could serve to enhance AAC service delivery. This study constitutes a first step towards such an investigation.

Iconicity has been established as an important factor in the learning of symbols. Information about the iconicity of symbols supports clinicians in vocabulary selection and is especially valuable in South Africa because of widespread illiteracy.

The purpose of this study was to investigate the iconicity of selected Picture Communication Symbols (PCS) for rural Zulu-speaking ten-year-olds. 94 participants were each presented with 36 copies of a commercially available matrix-36 communication overlay from which the glosses had been removed. The participants were required to match a symbol with a spoken isiZulu label. It was proposed that this methodology offers a high degree of social validity since it tests iconicity of symbols in the context in which they are generally used.

With both strict (iconicity values ≥ 75%) and lenient (iconicity values ≥ 50%) scoring criteria applied, respectively 2,8% and 11,1% of the symbols on the communication overlay emerged as iconic for participants. It was further established that the position of symbols on the overlay, the total frequency of selection of symbols, and gender did not influence results. Those symbols classified as nouns were on average the most iconic.

An analysis of errors revealed that for some symbols many of the participants agreed on a single specific label, be it the target label or a non-target label; while for other symbols either many possible labels, or none, were indicated. The term 'distinctiveness' was coined to describe how well-defined or specific the evoked meanings were that a symbol triggered in the mind of a viewer. Results suggest that participants did not make maximum use of the information afforded them by arrows in symbols. This finding is ascribed to the opaqueness of arrows, as well as participants' lack of previous experience with conventional cues in pictures. Clinical implications and recommendations for additional research are discussed.

Key words: augmentative and alternative communication (AAC), communication overlay, cross-cultural, iconicity, isiZulu, Picture Communication Symbols (PCS) and translation.

Opsomming

Dat kultuur 'n invloed het op die persepsie van prentmateriaal is lank reeds vasgestel en goed gedokumenteer. Aangesien die meeste grafiese simboolsisteme wat algemeen vir alternatiewe en aanvullende kommunikasie (AAK) gebruik word, prentagtig van aard is, kan die waarskynlikheid dat kultuurverskille 'n invloed op die gebruik van hierdie simboolsisteme moet hê, nie geïgnoreer word nie. Inligting omtrent die aard en graad van so 'n invloed kan lei tot die verbetering van AAK dienslewering. Hierdie studie is 'n eerste tree tot so 'n ondersoek.

Dit is bekend dat ikonisiteit 'n belangrike rol speel in die aanleer van simbole. Inligting aangaande die ikonisiteit van simbole steun terapeute in die proses van woordeskatseleksie en is veral in Suid-Afrika belangrik as gevolg van uitgebreide ongeletterdheid.

Die doel van hierdie studie was om die ikonisiteit van geselekteerde Picture Communication Symbols (PCS) vir tienjarige Zoeloekinders vanuit landelike gebiede te bepaal. 94 deelnemers het elk 36 afskrifte van'n kommersieel beskikbare kommunikasiebord ontvang. Die bord het 36 simbole, waarvan die geskrewe benaming verwyder is, bevat. Deelnemers is gevra om telkens 'n simbool met 'n gesproke isiZoeloe-frase af te paar. Daar word aangevoer dat hierdie metodologie die sosiale herhaalbaarheid van resultate verhoog aangesien ikonisiteit getoets word in die konteks waarin die simbole normaalweg gebruik word.

Met streng (ikonisiteitswaardes ≥ 75%) sowel as matige (ikonisiteitswaardes ≥ 50%) bepuntingskriteria gebruik, het onderskeidelik 2,8% en 11,1% van die simbole op die kommunikasiebord ikonies geblyk te wees vir die deelnemers. Die posisie van die onderskeie simbole op die kommunikasiebord, die totale frekwensie van seleksie van simbole, en geslag het nie die resultate beïnvloed nie. Simbole uit die selfstandige naamwoordkategorie was oor die algemeen die meeste ikonies.

'n Foutanalise het onthul dat sommige simbole min of meer eenstemmig in respons op een spesifieke frase, hetsy die teikenfrase of 'n nie-teikenfrase, aangedui is. Ander simbole is óf nooit, óf in respons op 'n wye verskeidenheid van frases aangedui. Die term 'kenmerkendheid' is gebruik om te beskryf hoe goed-gedefinieer of spesifiek die betekenis is wat 'n simbool in die denke van 'n kyker ontlok.

Uit die resultate blyk dit voorts dat deelnemers nie optimaal gebruik gemaak het van die inligting verskaf deur die pyle in simbole nie. Hierdie bevinding kan waarskynlik toegeskryf word aan die feit dat pyle hoogs abstrak is, asook aan deelnemers se gebrek aan ervaring met konvensies in Westerse tekeninge. Kliniese implikasies en aanbevelings vir verdere navorsing word bespreek.

Kernwoorde: alternatiewe en aanvullende kommunikasie (AAK), kommunikasiebord, kruis-kultureel, ikonisiteit, isiZoeloe, Picture Communication Symbols (PCS) en vertaling.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

A study performed by Alant (1999) found that 39% of all children attending special schools for students with severe mental disabilities in and around Pretoria were classified by their teachers as having little or no functional speech (LNFS). This figure is more than ten times higher than the prevalence figures for some developed countries (e.g. Burd, Hammes, Bornhoeft, & Fisher, 1988). It may be even higher if the fact that many children with severe mental disabilities in South Africa do not attend special schools (Schneider, Claassens, Kimmie, Morgan, Naicker, Roberts, & McLaren, 1999) is taken into account.

It is heartening to note that the present government of South Africa regards communication an important factor to take into account in their objective of integrating disabled people into society. One of the objectives of the White Paper on Integrated National Disability Strategy (1997) is to 'develop strategies that will provide people with communication difficulties with equal opportunities for access to information, as well as public and private services' (p35). Augmentative and alternative communication (AAC) certainly assists people with LNFS to access information and services, and research aimed at enhancing accountable service delivery to individuals with LNFS in South Africa is clearly warranted.

Picture Communication Symbols (PCS) (Johnson, 1981, 1985, 1992) is a set of aided, static communication symbols and is regarded as relatively iconic compared to other aided symbol sets and systems (Mirenda & Locke, 1989; Mizuko, 1987). Iconicity has been established as an important factor in symbol learning (Fuller, 1987; Fuller, 1997; Lloyd & Fuller, 1990; Lloyd, Loeding & Doherty, 1985; Luftig, 1983; Luftig, Page & Lloyd, 1983; Mizuko, 1987). However, since iconicity is defined as the degree to which an individual *perceives* visual similarity between a symbol and its referent (Blischak, Lloyd & Fuller, 1997), it is dependent to an extent on the viewer and it cannot be taken for granted that results obtained from studying one group of people can be generalised to another. Yet the iconicity of PCS has never before been investigated in the context of any of South Africa's many cultures. There is a need for culture-specific iconicity information in this country to enhance AAC intervention for individuals with LNFS.

KwaZulu-Natal (kwaZulu meaning 'place of the Zulus') is the province in South Africa with the second highest disability prevalence rate (6,7%) (Schneider et al., 1999). Furthermore, the

1996 census showed that 22,9% of South Africans speak isiZulu as their mother tongue (Burger, 2000, Official languages, para. 3), making it one of the largest linguistic groupings in the country. It stands to reason that a study involving them would make the results gleaned applicable to a large percentage of the population. An investigation into how Zulu-speaking children relate to PCS symbols could yield valuable information on how to modify the content, appearance or use of PCS symbols to facilitate symbol learning and use.

1.2 Outline of chapters

Chapter One serves as a brief statement of the problem that is addressed by this study. An outline of each chapter and an explanation of key terms and abbreviations used throughout the study are offered.

In *Chapter Two* a theoretical context for the study is provided. The delicate association between culture and the iconicity of pictures is discussed. Previous research regarding iconicity, and specifically cross-cultural research, is discussed. The testing of iconicity in the context of a commercially available communication overlay is described and methodological issues are considered.

The research methodology is presented in *Chapter Three*. The aims and design of the study are considered, and the preparatory phases are outlined in detail. The main study is discussed with reference to the participants, the data collecting procedure and the data analysis procedures.

Chapter Four contains the results in accordance with the aims of the research. The relative iconicity of symbols is indicated, followed by an analysis of errors and an investigation into factors that could have influenced results.

In *Chapter Five* an overview of the results is presented and the clinical implications of the findings are discussed. The study is critically evaluated to highlight strengths and limitations, and finally recommendations for further research are made.

1.3 Definition of terms

1.3.1 Communication overlay

In a general sense this term refers to letters, words, pictures or other graphic symbols that have been arranged on paper or some other material according to predetermined categories or topics (Quist & Lloyd, 1997) to serve as an assistive communication device. In this study a single overlay was selected from a range of commercially available communication overlays designed by Goossens', Crain and Elder (1996). These overlays are designed around a variety

of activities and aimed at reducing time spent by clinicians in preparing overlays. Copyright allows single agencies to photocopy overlays from the resource books (Goossens' et al., 1996).

1.3.2 Culture

"A set of behaviours, institutions, beliefs, technologies and values invented and passed on by a group of individuals to sustain what they believe to be a high quality of life and to negotiate their environments" (Taylor & Clarke, 1994, p. 103).

1.3.3 Distinctiveness

A term that has been coined for use in the present study. Distinctiveness aims at describing how well-defined or specific the evoked meanings are that a symbol triggers in the mind of a viewer. Two points are identified: distinct, where a symbol evokes only one particular meaning; and indistinct, where a symbol evokes either multiple meanings or none in the mind of a viewer.

1.3.4 Iconicity

A general term referring to the visual relationship between a symbol and its referent (Blischak et al., 1997). Transparency, a dimension of iconicity, describes symbols for which a viewer can readily see the relationship between symbol and referent, in the absence of the referent. Another dimension of iconicity is translucency, which refers to the degree to which a viewer perceives a relationship between symbol and referent in the presence of both. The absence of iconicity is called opaqueness. Evidently iconicity is a relative concept and therefore the terms 'more iconic' and 'less iconic' will be used throughout the text to describe symbols, according to arbitrarily selected cut-off points.

1.3.5 Iconicity values

The number of participants that responded correctly to an item is counted and represents that symbol's guessability or iconicity (Doherty, Daniloff & Lloyd, 1985).

1.3.6 Learnability

The ease with which a symbol can be learned by AAC users. A symbol is considered learned if the user can consistently pair the symbol and its label and can use the symbol appropriately.

1.3.7 Rural

The KwaZulu-Natal Department of Education and Culture does not employ a formal definition of this term. Informally 'rural' is defined as not living near a town or city (P. Müller, personal communication, July 9, 2001).

1.3.8 Symbol

In the broadest sense a symbol is anything that represents another concept or object (Blischak, et al., 1997). In the present study this term will mostly be used to refer to graphic communication symbols.

1.4 Abbreviations

AAC Alternative and Augmentative Communication

PCS Picture Communication Symbols

LNFS Little or no functional speech

R Researcher

RA Research assistant

p Participant

1.5 Summary

This chapter provides a motivation for the study by highlighting the need for information on the use of PCS in different cultural contexts. A brief outline of each chapter is presented. Definitions of terms and abbreviations used throughout the study are given.

CHAPTER 2

ICONICITY, CULTURE AND THE PERCEPTION OF PICTORIAL MATERIAL

2.1 Introduction

The aim of this chapter is to provide an overview of the relevant literature concerning iconicity. The influence of culture on the perception of symbols is discussed. Previous cross-cultural studies in the field of AAC are considered in order to highlight the need for the present study.

2.2 Iconicity of symbols

Iconicity refers to the visual relationship between a symbol and its referent (Fuller & Lloyd, 1991; Blischak et al., 1997). Fuller and Lloyd (1991) present an overview of the history of this term. According to them, iconicity was first described in 1965, and Bruner (1966) used it to describe a stage in the development of symbolic representation by children. Iconicity received some attention in the seventies (Bellugi & Klima, 1976; Hoemann, 1975). It seems that the hypothesis suggested by Fristoe and Lloyd (1979), that the iconicity of symbols might facilitate symbol learning, sparked interest in this variable. Numerous studies investigated iconicity in the eighties, many of which focused on unaided symbol sets/systems (Lloyd & Fuller, 1990). Some studies did however involve aided symbol sets/systems. A summary of the most prominent studies investigating the transparency or translucency of aided symbol sets/systems is presented in Table 1.

Inspection of Table 1 makes it clear that the majority of studies aiming to determine the transparency or translucency of a symbol set/system involved Blissymbols. Only three studies included PCS (Mizuko, 1987; Mirenda & Locke, 1989; Bloomberg, Karlan & Lloyd, 1990).

Table 1 also highlights that transparency studies typically employ one of two methodologies. In some studies on aided symbols, participants are shown a symbol and asked to guess its meaning (Luftig & Bersani, 1985). This creates an open-choice task where participants are not restricted in their responses. Other studies require participants to match a spoken label with a symbol from a closed set of alternatives (Mirenda & Locke, 1989; Mizuko, 1987; Musselwhite & Ruscello, 1984). The set of alternatives typically includes the target symbol and a small number of foils. For every trial the foils are varied, and foils are rarely included as

Table 1: A comparison of prominent studies on iconicity of aided symbol sets/systems performed after 1979

Title, authors, year	Objectives	Symbols used	Participants	Methodology	Results	Recommendations
Transparency of three communication symbol systems. **Musselwhite & Ruscello, (1984)**	· To determine the transparency of three symbol sets/systems for nonhandicapped viewers. · To investigate viewers' impressions of the symbol sets/systems.	Bliss Picsyms Rebus	· 48 typically developing participants in four age groups (y:m): · I: 3:0-3:11 · II: 6:0-6:11 · III: 9:0-9:11 · IV: 18:0-21:11	· Test booklet contained 40 target items for each set/system: · 30 word, 5 phrase and 5 sentence items · All items presented with 3 foils: one within grammatical category, two random. · Label was presented, P required to match to symbol.	· Blissymbols were significantly less transparent than Picsyms and Rebus. · All participants but one felt Blissymbols were the hardest. · Age significantly influenced performance on this task. · Gender did not influence performance on this task.	· A number of variables should be considered in selection of symbol set/system. · Transparency is especially important when AAC user will interact with nonreaders. · The transparency of these sets/systems should be studied individually including more symbols.
An initial investigation of translucency, transparency and component complexity of Blissymbolics. **Luftig & Bersani, (1985)**	· To measure transparency and translucency of a large sample of Blissymbols. · To investigate the effect of component complexity on transparency and translucency.	Bliss	95 naïve undergraduate college students	· Transparency: video consisting of 200 Blissymbols. P required to guess the meaning of each. · Translucency: video consisting of the same 200 Blissymbols, presented with written and spoken label. P required to rate visual similarity on scale of 1 to 7.	· Translucency and transparency values were determined. · Transparency values were surprisingly low. · No difference between word classes. · Translucency and transparency values were negatively influenced by number of components.	· Verbs were not more transparent than nouns, possibly because action indicator is opaque. · Abstraction is often indicated by adding components, which may explain why higher complexity leads to lower transparency.
Transparency and ease of learning of symbols represented by Blissymbols, PCS and Picsyms. **Mizuko, (1987)**	· To compare transparency and ease of learning of symbols across three different symbol sets/systems. · To compare transparency and learning across three different word categories (nouns, verbs and descriptors).	Bliss PCS Picsyms	36 typically developing preschoolers between 29 and 44 months	· 45 target symbols, each with three within word category foils. · Transparency: P required to match visual symbol to spoken label. · Learning: same as above, repeated three times. If P failed to match correct symbol to label, R corrected.	· PCS and Picsyms more transparent and easier to learn than Blissymbols, regardless of word category. · Nouns: similar scores for Picsyms and PCS, verbs and descriptors: PCS more transparent. · More PCS symbols were learned than Picsyms or Blissymbols.	· PCS and Picsyms may serve as immediate means of communication for disabled people with spoken comprehension skills of close to three years. · When a long-term communication system is needed, other aspects should also be considered.

(P = participants, R = researcher, PCS = Picture Communication Symbols).

Table 1 (continued): A comparison of prominent studies on iconicity of aided symbol sets/systems performed after 1979

Title, authors, year	Objectives	Symbols used	Participants	Methodology	Results	Recommendations
A comparison of symbol transparency in nonspeaking persons with intellectual disabilities. **Mirenda & Locke, (1989)**	· To determine if most common pictographic symbol sets fall into a predictable hierarchy of symbol transparency for persons with limited language ability. · To test a screening procedure for assessing symbol transparency.	Coloured line-drawings (Self-Talk) Rebus PCS Picsyms Bliss also standard objects, nonidentical miniature objects, colour photos, black-and-white photos, printed words	· 40 participants between ages (y:m) of 3:11 and 20:10. · Mildly to severely intellectually handicapped. · All nonspeaking (ASHA, 1981).	· Screening determined which protocol applied. · Standard receptive language protocol: P required to match symbol to spoken label. · Alternate 'yes/no' protocol: P required to answer yes/no on 'Is this a *target label*?'. · Matching protocol: P required to match symbol with object, or vice versa.	· Based on mean number correct across subjects, the following hierarchy emerged (easiest to hardest): objects, colour photos, black-and-white photos, mini objects, Picsyms, Self-Talk, PCS, Rebus, Blissymbols, written words. · This hierarchy applies to nouns only. · This procedure might have yielded the best possible results because of two-choice discrimination protocols.	· This hierarchy appears to be uniform across the intellectual disabilities studied. · Yet, the choice of a symbol set/system should be done in collaboration with the individual and family members concerned. · A bigger array of symbols, and more trials per symbol should be incorporated.
The comparative translucency of initial lexical items represented in five different categories **Bloomberg, Karlan & Lloyd, (1990)**	· To compare the translucency of AAC symbols selected to form an initial lexicon. · Comparison across symbol sets/systems, as well as across parts of speech.	Rebus Bliss PCS PIC Picsyms	50 naïve undergraduate university students.	· Booklet contained symbols from five sets/systems, representing 41 lexical items. · Symbol and label were presented, P required to rate visual similarity on scale of 1 to 7.	· Nouns significantly more translucent than verbs across sets/systems. · Picsyms and Blissymbols: verbs and modifiers equally translucent. · Rebus, PCS and PIC: verbs significantly more translucent than modifiers. · Considering all parts of speech (most translucent to least): Rebus and PCS (equivalent), PIC and Picsyms (equivalent), Blissymbols.	· Symbol sets/systems are not internally consistent with regard to translucency. · An initial lexicon should include symbols selected from a variety of sets/systems, having considered the translucency of each item as well as the experience of the potential user.
Translucency values for 910 Blissymbols. **Lloyd, Karlan & Nail-Chiwetalu, (unpublished)**	To determine reliable translucency values for a pool of 910 Blissymbols.	Bliss	348 naïve undergraduate college students.	· 910 symbols selected according to specific criteria. · Ten booklets each containing 100 symbols. · P required to rate visual similarity on scale of 1 to 7.	The mean rating, standard deviation, median rating, interquartile range, modal rating, minimum and maximum ratings for each symbol is presented.	· These translucency data should lead clinicians in the selection of an initial lexicon. · Other variables should however also be kept in mind.

(P = participants, R = researcher, PCS = Picture Communication Symbols).

target symbols in later trials. It has been reasoned that such a forced-choice task might be easier than an open-choice task (Musselwhite & Ruscello, 1984), possibly resulting in the best possible transparency values. It is suggested that the presentation of a larger set of alternatives might moderate the task so that more realistic transparency values may be obtained.

In a critique of their own study, Mirenda and Locke (1989) mention that communication overlays typically contain more than two symbols. They maintain that the inclusion of a larger number of symbols in iconicity tasks might yield more accurate results for intervention purposes. This serves as another motivation for including more foils in transparency tasks. These issues are discussed in more detail in 2.8.

2.3 Perception of symbols

Before visual similarity between a symbol and referent can be perceived, perception of the symbol must take place. A lot has been written about visual perception and cross-cultural differences in the perception of pictorial materials (Bloomer, 1990; Deregowski, 1980a,b; Duncan, Gourlay & Hudson, 1973; Miller, 1973). Since most of the graphic representational systems frequently used for augmentative and alternative communication (AAC) can be described as pictorial in nature, this field of study may yield valuable information applicable to graphic representational systems.

Deregowski (1980a,b) describes a picture as a representational pattern. Blischak et al. (1997) describe a symbol as something used to represent a concept or thing. It is argued that the term 'picture' as used in the literature on pictorial perception is inherently similar to the broader use of the term 'symbol' in AAC literature. For the purposes of the present study both terms are used rather interchangeably, depending on the literature being discussed.

According to Deregowski (1980a,b) the first step in the perception of a symbol is for the viewer to realise that the markings on the surface he is viewing, mean something. Consequently the viewer must discriminate figure from background, and finally he must realise that what he sees stands for something in the real world. In other words, the viewer must grasp the representational nature of the patterns he perceives.

If the viewer perceives the symbol as visually similar to its referent, he will independently guess the target label. Transparency tasks typically involve this function, so that transparency is operationally defined as 'guessability' (Fuller & Lloyd, 1991). If the viewer does not perceive a strong visual similarity, he follows one of two routes: he either fails to identify the symbol; or he utilises skills learned from previous experiences with symbols to arbitrarily assign a label to the symbol.

It seems that the viewer, rather than the symbol, determines success in the iconicity task. If the viewer does not perceive a strong visual similarity between symbol and referent, and cannot assign a label on the grounds of previous experience, the symbol is opaque to that individual, regardless of how other individuals perceive it. Furthermore, if the viewer obtains the necessary experience he might very well be able later on to assign a label to the very same symbol. The case of the medical student learning to interpret X-rays (Deregowski, 1980b) will serve as illustration. On the first encounter with an X-ray plate the student probably will not be able to perceive the meaning of the marks on the surface, so that the X-ray could be considered opaque. After exposure to X-rays and training in interpretation, the student manages to assign meaning to the very same X-ray plate, so that the plate would now be considered iconic. Indeed, it appears that iconicity is in the eye of the beholder (Kose, Beilin & O'Connor, 1983; Romski & Sevcik, 1988) and not in the strokes of the picture. Therefore iconicity must of necessity be investigated in terms of the viewer involved.

2.4 Possible influences on the perception of pictures

If iconicity should be investigated in terms of the viewer involved, it is important to know which factors may influence the viewer in interpreting symbols. Literature describes the influence of factors such as the material on which symbols are printed (Deregowski, 1980a,b; Sigel, 1978); schooling (Duncan et al., 1973; Martlew & Connoly, 1996), thinking styles (Almanza & Mosley, 1980; Cole & Scribner, 1974; Retief, 1988; Solarsh, 2001; Taylor, 1994; Taylor & Clarke, 1994; Witkin, 1967), oral or literate background of viewer (Canonici, 1996; Havelock, 1963; Ong, 1982) and previous experience with symbols (DeLoache, 1991; Duncan et al., 1973; Friedman & Stevenson, 1975; Kose et al., 1983; Miller 1973; Sigel, 1978; Stephenson & Linfoot, 1996). These factors are described in the following sections.

2.4.1 The material on which symbols are printed

Deregowski (1980b; see also Sigel, 1978) describes how members of an Ethiopian tribe could recognise the pictures printed on coarse cloth, a material which they knew; yet when pictures were presented on paper – a material unknown to them – they tasted and smelled the paper and did not recognise the pictures. In this instance perception was inhibited by the use of foreign material.

2.4.2 Schooling

In a study performed by Martlew and Connoly (1996), human figure drawing of schooled and unschooled children in Papua New Guinea were compared. Children came from a remote area with no tradition of graphic art. It was found that the figures drawn by children who had

attended school were more sophisticated than figures drawn by children who had not attended school. They argued that school provided contact with drawings and opportunities to draw, which could aid the development of drawing in children. Although this study investigated drawing and not perception, it can be argued that previous exposure to pictures and symbols afforded by schooling would have similar facilitative effects on perception.

DeLoache (1991) proposed that participation in tasks involving one symbol system promoted understanding of subsequent tasks involving other symbol systems. Thus it was argued that contact with the literate culture of school facilitated the development of general symbolic understanding in the Papa New Guinea children, leading to more sophisticated drawings. This argument can be once again be applied to symbol perception. Since symbol perception and literacy are both symbolic tasks, participation in literacy activities at school might facilitate the perception of symbols. It therefore seems plausible that schooling might have a positive influence on picture perception skills.

Duncan et al. (1973) propose that it may not be formal education alone that familiarises people from other culture groups with the pictorial conventions of the West. They investigated urban and rural children from three cultures. All the children attended school, but they had different opportunities for exposure to pictorial material, and these opportunities correlated positively with picture perception abilities. These results suggest that exposure to pictures per se, not necessarily in connection with formal schooling, also serves to develop picture perception skills.

2.4.3 Previous experience with symbols

Kose et al. (1983) found that children between the ages of three and six from middle-class suburban neighbourhoods could imitate actions depicted in drawings and by live models or dolls better than actions depicted in photographs. While these children were familiar with dolls and drawings, they presumably did not know photographs well enough to understand how three-dimensional information could be transformed into two-dimensional presentations by a camera. The authors argued that possibly this lack of experience with photographs and cameras could have influenced the results.

Macintosh (1977) describes how a certain Aborigine could interpret the paintings in a cave but could not recognise representations of the paintings on paper, possibly because of his unfamiliarity with such recordings.

As mentioned earlier, Duncan et al. (1973) found a correlation between children's exposure to pictorial material and their pictorial perceptual ability. This correlation seemed the greatest

where 'artificial' cues were included in pictures, such as various conventions used to indicate action. They propose that since these cues are used arbitrarily, they are opaque to any person who has not previously been exposed to them. There appears to be general consensus in the literature that experience with symbols facilitates perception of symbols (DeLoache, 1991; Friedman & Stevenson, 1975; Miller 1973; Sigel, 1978; Stephenson & Linfoot, 1996).

2.4.4 Thinking styles

The term *thinking styles* refers to the consistent, characteristic mode of functioning that pervades the perceptual and intellectual activities of an individual (Witkin, 1967; Cole & Scribner, 1974). Witkin (1967) proposed an overall dimension along which all individuals can be placed and called it the *global-articulated* dimension of cognitive functioning. When this dimension is used specifically in relation to perception it is generally referred to as *field-dependence-independence* (Almanza & Mosley, 1980; Cole & Scribner, 1974; Retief, 1988; Solarsh, 2001; Taylor, 1994; Taylor & Clarke, 1994). It postulates that field-independent individuals (typically from European and Asian groups) analyse information and pay great attention to detail (Taylor, 1994). Field-dependent individuals, like those from African, African-American and Hispanic groups, view information in relation to the context in which it is presented. They can be described as socially orientated (Taylor, 1994).

These thinking styles have a definite influence on symbol perception. Field-independent individuals find it easy 'to perceive specific objects within a perceptual pattern as discrete entities' (Almanza & Mosley, 1980, p.610). For field-dependent individuals specific aspects of a perceptual pattern are overwhelmed by the characteristics of the global pattern. The embedded figure test is one of the tests used in determining field-dependence-independence. Participants are first shown a simple figure and then a more complex figure that contains the simple figure. Those who can analyse the complex figure to find the simple one are generally considered to employ a field-independent cognitive style, and vice versa. It should be emphasised that both styles are legitimate ways of thinking and the predominance of one style does not exclude the presence of the other (Almanza & Mosley, 1980; Hall, 1976; Solarsh, 2001; Taylor, 1994; Witkin, 1967).

In similar vein Hall (1976) differentiates between high-context and low-context cultures. In high-context cultures, like that of American Indians, Chinese and Japanese, individuals depend on the context of a transaction and on the pre-programmed information shared by them. Low-context cultures, like most Western cultures, are more concerned with the content or meaning of a communication than with its context.

Although different names have been allocated to the continuum of thinking styles, the underlying constructs seem similar, and that these consistent styles of functioning would influence symbol perception seems evident.

2.4.5 An oral versus literate state of mind

Before the advent of literacy in the old Greek civilisation, all information had to be memorised for it to survive, since there existed no means of recording it efficiently and unambiguously. This led to the development of an oral style rich in rhythmic and metrical patterns, primarily for mnemonic purposes (Havelock, 1963). Constant repetition and intense identification with the actors in epics were also employed as memory aids. Events were relived so intensely that no energy was left to analyze and reflect on the information that was memorized (Havelock, 1963).

It is argued that these attempts at remembering information led to distinct ways of thinking (Olson, 1994; Ong, 1982). Ong (1982) describes several characteristics of such orally based thought, and makes it clear that these apply to primary oral cultures: cultures that are wholly untouched by literacy. Such cultures are rare. Through the widespread use of instruments like television, telephone and even radio most 'oral' cultures today have had some contact with writing, resulting in 'secondary orality' (Ong, 1982).

The Zulu culture as it presently stands can probably be described as a secondary oral culture. The first written form of Zulu was developed in the 1840's by missionaries (Canonici, 1996). It is debatable whether access to printed matter since then had been adequate to promote a bookish culture among Zulus. Indeed, Duncan et al. (1973), Macdonald (1990) and Solarsh (2001) report on children's limited access to books and magazines. Today Zulu culture still includes oral traditions like the performance of folktales and poems and the prominence of praise names (Canonici, 1996). Yet it seems probable that most rural families have been exposed to print in some form. A recent study performed as the pilot for the Census At School (2001) project surveyed 43 500 learners from across the country (CensusAtSchool, 2001). Results showed that 93,9% of learners had radios and 74,8% had televisions in their own homes. These factors should caution the reader that the oral traditions found among Zulus today is secondary in nature. The influence of orality on symbol perception, although it probably exists, will not be easy to isolate.

2.5 The encompassing influence of culture

When these aspects are considered, it becomes evident that each aspect is in turn influenced by culture. Taylor and Clarke (1994) circumscribe culture as 'a set of behaviours, institutions,

beliefs, technologies and values invented and passed on by a group of individuals to sustain what they believe to be a high quality of life and to negotiate their environments' (p. 103). In short, culture is '... a perceptually shared reality, a world view' (Bloomer, 1990, p.16). Thus it is not inaccurate to assert that culture influences every thought process and action of human beings. More specifically with regard to what has been discussed above, culture undeniably dictates to a significant extent the material an individual is familiar with, whether the individual attends school or not, what thinking style he utilises, whether he operates from an oral or literate state of mind and whether he has had previous experiences with symbols or not. It seems that culture will have an overwhelming influence on the perception of symbols.

2.6 Implications for AAC

It is often stated as good practice to select symbols that are easy to learn as the first symbols to be taught (Fuller, 1997; Lloyd & Fuller, 1990; Mirenda & Locke, 1989). This strategy facilitates communication while at the same time creating success that in turn motivates the user. Iconicity information can greatly aid clinicians in such a selection, since iconic symbols are easier to learn (Fuller, 1987; Fuller, 1997; Lloyd & Fuller, 1990; Lloyd et al., 1997; Lloyd et al., 1985; Luftig, 1983; Luftig et al., 1983; Mizuko, 1987). Furthermore, information about the iconicity of symbols is especially valuable in South Africa because of widespread illiteracy. A literate communication partner can read the gloss that accompanies a symbol, but illiterate partners have to rely on the transparency of the symbols to guess its meaning. As Dunham (1989) pointed out, it is expensive and virtually impossible to train all possible communication partners in the use of the relevant symbol set/system, so that the use of iconic symbol sets/systems is more efficient.

Iconicity information therefore has tremendous value for selecting a symbol set or system for individuals in need of AAC in South Africa. As has been shown, however, this information is most useful if it is culture-specific.

2.7 Previous cross-cultural studies

Huer (2000) mentions the lack of AAC research that incorporates participants from non-European-American communities. A review of the literature yielded only three such studies. For the sake of clarity and ease of comparison, the particular objectives, methodological issues, research findings and recommendations of these studies are presented in Table 2.

Table 2: A comparison of previous cross-cultural AAC studies

Title, authors, year	Objectives	Symbols used	Participants	Methodology	Results	Recommendations
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. **Nakamura, Newell, Alm & Waller (1998)**	To determine the influence of word order and lack of particles on the performance of Japanese speakers when using graphic symbol sets that rely on English SVO word order.	PCS	· 80 naïve Japanese university students · Proficient in spoken and written Japanese · (In Japanese, particles rather than word order indicate subject and object. Most common word order is SOV).	· P listened to Japanese folktale. · 40 answered 5 questions using PCS alone, 40 with PCS and added particle array. · For half symbols were arranged in SVO order, for half in SOV order. · Interview with P after experiment.	· P used particles when available and reported difficulty when not available. · P produced more SOV than SVO sentences; no SVO sentences produced when particles were available.	· Particles should be added to graphic symbol sets, but may lower iconicity. · Thus add particles for users with adequate language ability. · English equivalent can be to add prepositions and tense markers.
Examining perceptions of graphic symbols across cultures: Preliminary study of the impact of culture/ethnicity. **Huer (2000)**	To examine the impact of culture/ethnicity on participants' perception of graphic symbols.	PCS DynaSyms Bliss	· 147 adults from comparable backgrounds but different cultures: European American, African-American, Chinese, Mexican	· Comparable to Bloomberg et al., (1990). · Labels of symbols were translated. · P presented with symbol and label, rated translucency on 7-point scale.	· Order of rankings the same across groups. · PCS most translucent, then DynaSyms, then Blissymbols. · Ratings within symbol sets showed significant differences.	· Developers of AAC symbol sets should take culture into account. · AAC symbols should be selected in consultation with users and families. · Participant selection and translation of labels important issues in further research.
Development and cultural validation of lexicon for Asian-Indian individuals who need alternative and augmentative communication. **Nigam, Nigam, Kiran, Koul, Pandita & Srinivasan (unpublished)**	· To culturally validate the PCS lexicon for Asian-Indian AAC users. · To develop a culturally relevant core lexicon for Asian-Indian AAC users.	PCS	· 120 adults from five different regions in India; some rural, some urban. · Different socio-economic backgrounds. · Previous contact with AAC user.	· Nomination: P nominated all words they deemed necessary for AAC users, first categorical, then non-categorical. · Rating: P rated the usefulness of existing PCS lexical items.	· 88 words nominated were not found in PCS lexicon · 247 PCS lexical items were rated as having no meaning to Asian-Indian AAC users. · Variation in lexical need across regional environments were found.	· Methodology was effective for cultural validation. · Next step: to determine the iconicity of existing symbols. · Asian-Indian artists should draw symbols for new words and for symbols that are low in iconicity.

(P = participants PCS = Picture Communication Symbols)

As can be seen in Table 2, only one of these studies investigated iconicity (Huer, 2000), and more specifically the dimension of translucency. African-American participants were included in this study, but since all of them were born and educated in America, the results cannot be applied to cultures indigenous to Africa. A real need for translucency and transparency data for African cultures is evident.

2.8 Iconicity in the context of a communication overlay

As mentioned in 2.2, Mirenda and Locke (1989) caution readers that the two-choice discrimination protocol used in their study probably produced the best possible transparency scores. They suggest that since communication overlays typically contain more than two symbols, the inclusion of a larger number of symbols in iconicity tasks might yield more accurate results for intervention purposes. Furthermore it can be argued that in order to obtain socially valid results, the iconicity of symbols should be investigated in the context in which those symbols are used most often.

In the light of these arguments the investigation of iconicity in the context of a communication overlay should be considered. Instead of presenting a participant with three to five symbols from which to choose, an entire overlay is presented.

Such a task would differ from those in previous iconicity studies in four important ways. Firstly, when participants are presented with a complete communication overlay, the set of alternatives is substantially larger than those in previous studies. This is one of the main motivations behind the methodology. Secondly, all symbols will be semantically related to the same theme and therefore possibly to each other, even if indirectly. The impact of this factor cannot be predicted. Thirdly, the 36 symbols comprising the set of alternatives will remain static across all 36 trials; and fourthly, each symbol will in time be the target symbol. This creates the possibility that some participants may remember which symbols they had chosen for several consecutive trials and, in response to the next labels, narrow their selection down to those not yet chosen. The possibility that a combination of these factors might influence the iconicity values obtained, should be kept in mind.

Goossens' et al. (1996) designed communication overlays of three different matrix sizes consisting of PCS symbols. Each overlay is organised around a theme and contains certain standard symbols, as well as theme-specific symbols. The placement of the symbols is governed by factors such as accessibility of high-use symbols, and grammatical category of symbols. Since these overlays can be photocopied directly from the manual, they are widely

used in South Africa, mostly unmodified. The use of an overlay from this collection therefore seemed appropriate for the present study.

As Fuller and Lloyd (1991) called for consistency in the use of iconicity terminology in order to avoid confusion, careful consideration had to be given to whether a task such as the one proposed would measure transparency or translucency. Transparency refers to 'the ease of identification of symbols when no additional cues, such as printed labels or verbal hints, are provided' (Musselwhite & Ruscello, 1984, p.437). In the proposed task participants would be indicating symbols in response to labels. Although such a task is typically employed in transparency studies, this term would not be appropriate since 'additional cues' would be provided by the theme of the overlay. Translucency on the other hand, is typically determined by presenting participants with a symbol and its referent, asking them to rate on a 5- or 7-point scale the extent to which the symbol looks like its referent. In the proposed task no ratings would be required from participants, so that the term translucency would not apply either. It could be argued that use of the more general term 'iconicity' would be most accurate; consequently this term is used throughout the study.

2.9 Summary

The purpose of this chapter is to show that iconicity cannot be investigated without taking into account the culture of the viewers involved. Furthermore information on iconicity specific to the cultures in South Africa is needed to ensure accountable service delivery. It is also argued that in order to obtain more valid iconicity results, symbols should be presented in the context they are most often used in. Thus the need for the present study becomes evident.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

In this chapter the research methodology is discussed. The aims and sub-aims of the study are identified, where after the research design is discussed. The procedure and results of the pilot study, as well as subsequent recommendations, are presented. The main study is described in terms of the criteria used for participant selection, materials and equipment used and data collection and analysis procedures.

3.2 Aims

3.2.1 Primary aim

The primary aim of this study is to determine how accurately typically developing rural Zulu-speaking ten-year-olds can identify 36 Picture Communication Symbols (PCS), presented thematically on a commercially available communication overlay, in response to spoken labels.

3.2.2 Sub-aims

The sub-aims of this study are:

1. To select a commercially available communication overlay which contains no concepts that are foreign to rural Zulu-speaking children.
2. To determine how accurately ten-year-old Zulu children select the correct symbol in response to its spoken label.
3. To describe error patterns.
4. To investigate factors that could influence results, specifically total frequency of selection, position on overlay and gender.

3.3 Research design

3.3.1 Description of the research design

The nature of this study was exploratory. An analytical survey was conducted in which 94 rural Zulu speakers were exposed to 36 PCS symbols in the context of a commercially available communication overlay. In response to a verbal label they had to mark the symbol they thought best depicted that concept. Sampling was purposive in the sense that schools

were selected according to accessibility. At the selected schools however, all children that met selection criteria were included in the study. The data was quantitative in nature and was therefore subjected to statistical analysis to extract meaning.

3.3.2 Research phases

The research consisted of the following phases:

- Preparatory phase
  - selection and translation of a suitable communication overlay (Goossens' et al., 1996)
  - development of a test protocol
  - training of the research assistant
  - execution of a pilot study to pretest the validity of the translation and test protocol
- Main study
  - selection of schools to be included in the sample
  - collection of data
  - capture and statistical analysis of data

3.4 Preparatory phase

In order to simulate the real-life use of PCS symbols as closely as possible, it was decided to use a communication overlay as designed and published by Goossens' et al. (1996). These overlays are used widely in this country and provide a measure of context through being organised around a theme. The preparatory phase consisted of the selection and translation of an appropriate overlay, training of the research assistant, development of a test protocol as well as pretesting the translation and test protocol in the pilot study.

3.4.1 Selection of a communication overlay

Sechrest, Fay and Zaidi (1972) use the term 'cultural distance' as a description of the degree to which objects and experiences in one culture differ from that in another culture. The aim of the selection process was to minimise cultural distance between the concepts represented on the overlay and the experiential background of the target population. The basic content of the overlay had to form part of the world knowledge of children from the target population (Blachowicz, 1994). The selection process is outlined in Figure 1.

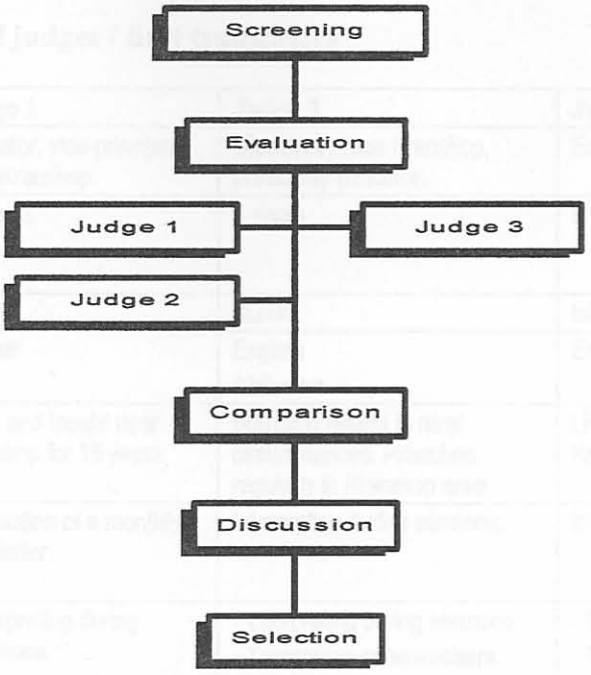


Figure 1: Schematic representation of the selection process

3.4.1.1 Step one: Screening

A preliminary screening by the researcher of the Goossens' et al. (1996) collection of matrix-36 communication overlays yielded five overlays that did not contain obvious foreign concepts: Washing and Drying Dishes by Hand (p. 258); Taking a Walk (p. 252); Preparing Coffee / Tea (p. 229); Making the Bed (p. 217) and Selecting Clothes (p. 233).

3.4.1.2 Step two: Evaluation by judges

The concepts contained in these five overlays were subjected to scrutiny by a panel of judges consisting of three educators from the Kranskop East Circuit (see Table 3). None of the educators were associated with any of the schools in the sample.

The English sentences/phrases were presented to the judges without the symbols. They were asked to indicate which concepts they thought could be foreign to members of the target population. For exact instructions given, see Appendix K. The judges worked independently.

Table 3: Description of judges / first translators

	Judge 1	Judge 2	Judge 3
Occupation	Educator, vice-principal near Kranskop.	Missionary near Kranskop, previously educator.	Educator near Kranskop.
Years of experience with children in the area	15 years	4 years	9 years
Mother tongue	isiZulu	isiZulu	isiZulu
Other languages	English	English Afrikaans	English
Experience with rural areas near Kranskop	Lived and taught near Kranskop for 15 years	Born and reared in rural circumstances. Preaches regularly in Kranskop area	Lived and taught near Kranskop for 8 years
Experience with isiZulu to English translation	Translation of a monthly newsletter.	Interpreting during sermons.	Interpreting during sermons.
Experience with English to isiZulu translation	· Interpreting during sermons. · Translation of newsletters.	· Interpreting during sermons. · Translation of newsletters.	· Interpreting during sermons since 1986. · Translation in isiZulu Third Langauge instruction.

3.4.1.3 Step three: Comparison

The researcher compared the work of the judges with one another. The concepts queried by the judges are presented in condensed form in Table 4.

Table 4: Concepts questioned by judges

Nr	Theme	Judge 1	Judge 2	Judge 3
1	Washing and Drying Dishes by Hand	No queries.	34. Let's leave it on the *counter.*	28. In the *drawer.*
2	Taking a Walk	4. Let's head out.	No queries.	4. Let's head out. 9. ...around the block 16. Wow! 17. Gross
3	Selecting Clothes	16. It matches.	No queries.	No queries.
4	Preparing Coffee / Tea	No queries.	14. Look in the *counter.* 15. Look in the closet.	13. Look in the *drawer.*
5	Making the Bed	No queries.	No queries.	31. Whoops!

3.4.1.4 Step four: Discussion

Both overlays 3 and 5 had only one concept queried. Consequently Judge 1 and Judge 3 were approached and asked to decide which of the two concepts would be the most foreign. Judge 1 maintained that 'It matches' would be unfamiliar to the target population. Judge 3 acknowledged that he had queried the concept 'Whoops' not because of potential unfamiliarity, but because of potential difficulty with translation.

3.4.1.5 *Step five: Selection*

It was decided to use Overlay 5: Making the Bed.

Although it was not required of judges to judge extra items in order to calculate reliability, a high degree of consistency in their responses is evident. Where they deemed a certain word unfamiliar, they indicated all occurrences of that word across overlays (see cursive in Table 4).

3.4.2 Translation of symbol labels

To minimise the influence of linguistic factors on the performance of participants, the entire procedure was conducted in isiZulu. Consequently all labels, that is the sentence/phrase accompanying each symbol on the overlay, had to be translated into isiZulu.

3.4.2.1 *General considerations*

In this study the goal was to translate the labels of the 36 concepts on the communication overlay into the target language, but also into the target culture so that participants could identify with it. Brislin (1980) calls this ethnographic translation. According to Retief (1988) the best way to accomplish valid ethnographic translation is to involve persons that are familiar with both the source and the target language. For this reason mother tongue speakers of isiZulu with proficiency in English, as well as mother tongue speakers of English with proficiency in isiZulu, were included as judges and translators in this study.

Since cultural knowledge develops through membership to and interaction with members from a group (Hetzroni & Harris, 1996; Taylor & Clarke, 1994), care was taken to select persons that had had considerable experience with both cultures. Furthermore all judges and translators involved had obtained at least their senior certificate (Bracken & Barona, 1991). All were indigenous to the area and familiar with members of the target population.

The whole process of selection and translation involved eight people, five of which were mother tongue speakers of isiZulu, two of which spoke English as a mother tongue and one who spoke German as mother tongue. The German translator was included because of his proficiency in English and Zulu and his many years' experience especially with the vernacular Zulu of the region. The involvement of many translators was aimed at enhancing the validity of the translation.

Brislin (1980) discusses four basic translation methods, namely back translation, the bilingual technique, the committee approach and pretest procedures. For a compact description of each method the reader is referred to Retief (1988). The steps suggested by Bracken and Barona

(1991) are similar: source to target language translation, blind back-translation, translation – back-translation repetition and bilingual review committee. The present study employed a synthesis of the blind back-translation, review committee and pretest procedures. Three first translators independently translated the source phrases into isiZulu. These three translations were reviewed by the three first translators and modified until they agreed on one translation, the First Consensus (see Appendix C). The First Consensus was translated back to English by three second translators individually. The researcher compared the three back translations, and six of the 36 phrases were not the same across translations. The second translators were shown the source text and asked to suggest better isiZulu phrases for the six problem phrases. These suggestions were laid before two of the first translators who ultimately decided on which phrases would be used to form the Second Consensus (see Appendix C). The Second Consensus was presented to two third translators, who once again translated it into English. It seemed that no more changes were needed, and the translation was pretested in the Pilot Study. Minor changes resulted in the Final Consensus (see Appendix C). The process is reflected in Figure 2. The different steps are discussed in detail in Table 5 to Table 7.

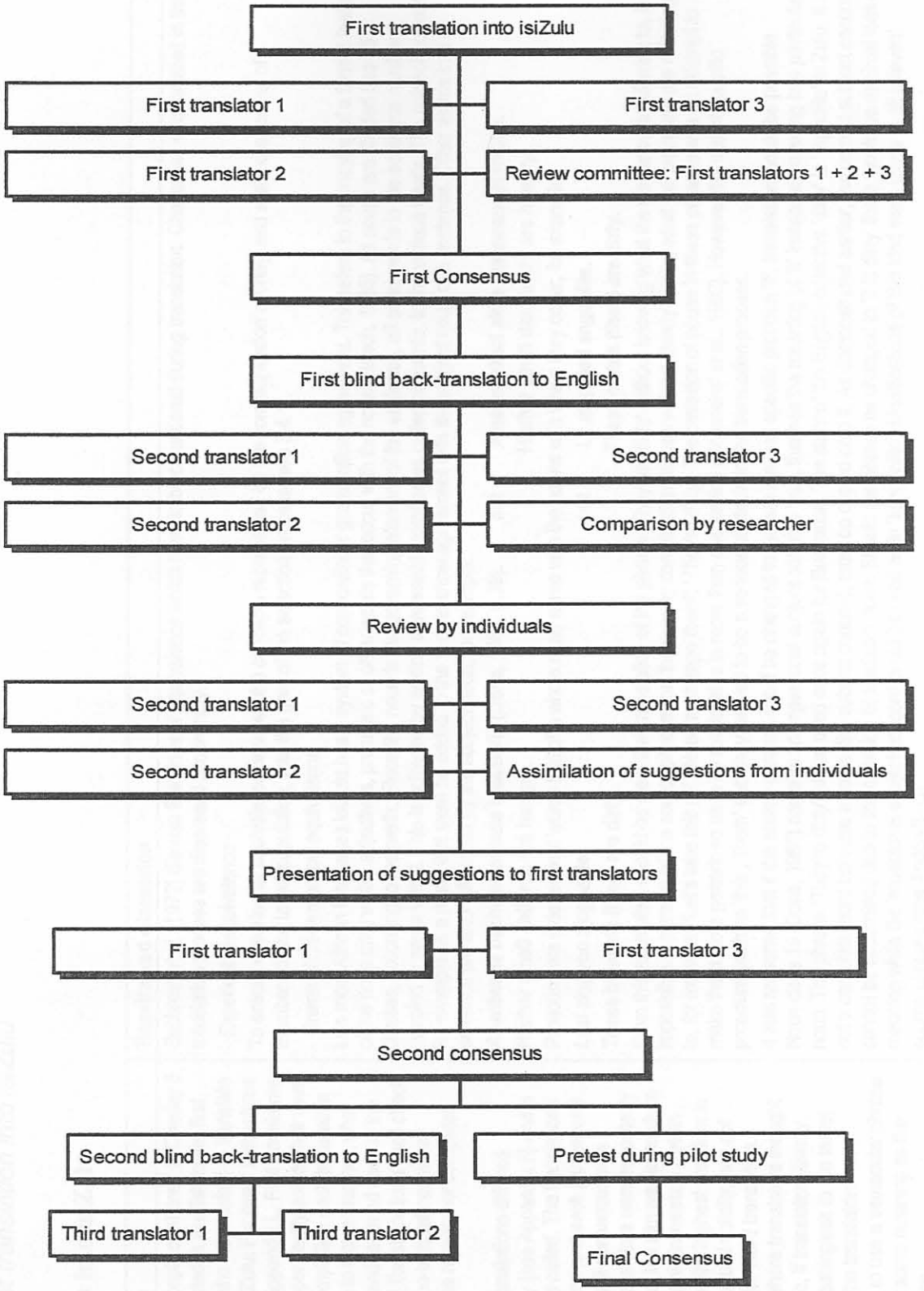


Figure 2: Schematic representation of the translation process

3.4.2.2 *Step one: First translation into isiZulu*

Table 5: First translation into isiZulu

People involved	Procedure	Results and discussion
The panel of judges served as the first panel of translators. A description of the first translators is presented in Table 3.	The 36 concepts contained in Overlay 5 were presented in English to the first translators who were asked to translate them into isiZulu. For exact instructions given, see Appendix L. First translators worked independently and at their own pace. On completion each translation was handed to the researcher, who typed them and returned each to the relevant first translator for a spell check. Once all three translations were corrected, the researcher compared them. The three translations differed considerably (see Appendix F) and a meeting was called. The translations were reviewed and each phrase was discussed until consensus was reached. Translators were repeatedly reminded that the aim was to produce an ethnographic translation (Brislin, 1980), where the highest premium is placed on cultural validity, and not literal word-for-word translation. Therefore, where translators thought that a phrase, if translated literally, would be meaningless to the target population, the translators were encouraged to use a vernacular phrase that had the same meaning as the source phrase.	Sechrest et al. (1972) discuss five kinds of equivalence which have to be considered during translation. Challenges encountered in the translation process are discussed accordingly. · Experiential equivalence To ensure experiential equivalence between the concepts represented on the communication overlay, and real experiences of members of the target population, was the goal of the selection process (see 3.4.1). · Grammatical-syntactical equivalence Like most African languages isiZulu has a system of concordial or grammatical agreement. This refers to the copying of a formal feature of the noun onto verbs, adjectives, pronouns or other words that occur with the noun (Bosch, 1985). All nouns are divided into 15 classes, according to the prefix. Since the noun is the governing element of the sentence, all other words in the sentence must be adapted to agree with it. This is achieved by adding agreement morphemes called concords, to the various words. The subject concord, for example, is a prefix that must be added to the verb to show agreement with the subject noun of a sentence. Other words in a sentence are also influenced by the subject noun, for example: ***Aba**ntwana **ba**khe **aba**ncane **ba**lambile (Doke, 1968, p.39).* **but** ***Ama**dodakazi **a**khe **ama**ncane **a**lambile.* **His/her small children are hungry.** **His/her small daughters are hungry.** Pronouns are independent words that of a whole must agree with the nouns with which they occur, for example: ***Lezi zi**ngubo **zi**ngcolile.* **but** ***La ma**puleti **a**ngcolile.* **These blankets (they) are dirty.** **These plates (they) are dirty.** From this example it should be clear that translation of the phrase 'They are dirty' without knowing what the sentence is referring to, is impossible. A number of the source phrases on the overlay contained pronouns without clearly stating what the pronouns are referring to, for example, 'Let's take *this* off'; 'Need to change *them*'; '*They*'re dirty'. The omission of nouns in these phrases was an attempt to make them more generic so as to be serviceable in more than one setting (Goossens' et al., 1992). However the use of specific pronouns such as 'this', 'them' and 'they' proved to be a serious obstacle in the translation process. It was reasoned that if the source phrases could be changed to include the less specific pronoun 'it', translation would be possible. Noun class 10 (Doke, 1968) contains an impersonal subject concord 'ku-', that has the meaning of 'it' instead of referring to a particular noun. The phrase 'They're dirty' will be used once again for illustration. The stem of the English adjective 'dirty' is '-ngcolile' in Zulu. It is not a complete word because a prefix, the subject concord, must be copied onto it. As demonstrated earlier, the correct subject concord cannot be determined due to the omission of a subject noun. Should the phrase be changed to 'It is dirty' there would be minimal loss of meaning while the impersonal subject concord could be used as in '*ku*ngcolile'. Modifications of this kind were made to all relevant source phrases (see Appendix G).

Table 5: First translation into isiZulu

People involved	Procedure	Results and discussion
		Similar problems were experienced with the 'lead-ins' with which many of the sentences started. Phrases such as 'Got to…'; 'Have to…'; 'Need to…' and 'Let's…' were used to temper the imperative value of some sentences and to make them serviceable for self-talk (Goossens' et al., 1992). Sentences starting with 'Let's…' could be accurately translated since the subject was known ('us'). When sentences started with an auxiliary verb without indicating the subject, as for 'Got to…' Have to…' and 'Need to…', accurate translation was impossible. These source phrases were modified to start with 'You…' (see Appendix G). It should be noted that the phrase 'Let me' does not include a main verb, which resulted in an incomplete isiZulu sentence that might have been foreign to the participants. For illustration the sentence 'Let me help' is used. In this sentence the speaker is the subject. Therefore, when this sentence is translated into isiZulu, the first person subject concord 'ngi-' is added to the main verb '-siza' as in 'Ake *ngi*size'. If the main verb was not known, the last word of the sentence would not be complete. Since the source phrase 'Let me' contained no main verb, it was translated to 'Ake ngi-' which is not a complete sentence and therefore might have been foreign to the participants. The fact that isiZulu is a tonal language had to be considered. The tone used when pronouncing an utterance carries meaning (Doke, 1968; Dent & Nyembezi, 1969). This complicated translation, since certain phrases can have several meanings which are impossible to discriminate in context-free print. The translation for the statement 'It is nice and clean' for example, if intonated in another way, could be used as an imperative: 'Make it nice and clean'. It was decided that during training, the research assistant would be informed of the intended meaning of each phrase in order to ensure correct intonation. · Vocabulary equivalence The phrase 'Put it in the hamper' was interpreted as 'Put it in the (receptacle for dirty washing)'. According to first translators rural Zulus have different receptacles for dirty washing. After some discussion they agreed that although a basket may be used by urban Zulus, a plastic tub is used most often in rural areas. The phrase was translated accordingly. · Idiomatic equivalence The translation of an interjection is very difficult since it rather has emotional value than a clearly definable meaning. The interjection 'Whoops' is explained as 'an exclamation of apology or dismay, as at a blunder' (Barnhart & Barnhart, 1992, p. 1454) and 'used when one has almost had an accident, broke something etc.' (Cowie, 1989, p. 1459). The first translators had difficulty finding a phrase that conveyed the same emotional value, and consequently they agreed upon the interjection 'Hhayi bo!', with some reserve. According to the first translators there is no set expression in isiZulu for 'You are welcome'. Although there are some phrases that can be used, the typical response to being thanked is to thank the speaker in return. Three of the five overlays presented to the judges contained this phrase, and it is unfortunate that the judges did not notice it when this specific overlay was considered. Nevertheless a satisfactory translation was easily found and no further problems was experienced with this phrase. · Conceptual equivalence The phrase 'Have to make it fat' was interpreted in the context of this specific overlay as meaning puffing up a pillow or duvet. If translated literally, the result would have been applicable to people only, and not to bed linen. The phrase was therefore changed to 'Puff it up'.

The result of this phase of translation was called the First Consensus (see Appendix C).

3.4.2.3 *Steps two to four*

Table 6: First blind back-translation, review and suggestions

Step	People involved	Procedure	Results and discussion
Step two First blind back-translation into English	The second translators (see Table 8).	The First Consensus (see Appendix C) was presented to the second translators, who worked independently and without knowledge of the theme of the communication overlay. For exact instructions, see Appendix M. On completion each translation was handed to the researcher. Translations were compared by the researcher.	Thirty phrases correlated highly across all three second translators. Two of the phrases were completely foreign to all three second translators and for four phrases translations differed, resulting in six problem phrases (see Table 10).
Step three Review by individuals	The second translators (see Table 8).	Each of the three second translators were approached individually and shown the English source text as well as the First Consensus. They were requested to suggest better translations for each of the six problem phrases.	The second translators offered no suggestions for the problem phrase 'Fold it back' (see Table 10). The back translations into English for this phrase differed and therefore it was included in the list of problem phrases. When the second translators saw the source phrase however, all maintained that 'Kugoqele emuva' was the best translation after all. The same explanation applies for problem phrase "It is nice and soft'. The suggestions made were written down.
Step four Presentation of suggestions to first translators	Two of the first translators, Judges 1 and 3 (see Table 3).	The suggestions from step three were presented to Judges 1 and 3, who made the final decision regarding which translations would be used.	The translation that was used for 'pillowcase' is 'iphilo'. This is a colloquialism derived from English. All three second translators thought it meant 'pillow'. The first translators maintained however that it was the accepted word for 'pillowcase'. This was confirmed by several grade 12 isiZulu-speakers who were questioned informally. The translation for the problem phrase 'Let us put on' was not known to any of the second translators. Translator 6 consulted a dictionary to find the meaning. It was suggested that a more widely used word be selected. The first translators maintained that 'maseleke' was the best translation but consented to the use of 'masendlale'. The first translation for 'Puff it up' ('Uvokomalise') was also not understood by any of the three second translators, and a more child-friendly form of the word ('Khukhumalisa') was suggested and accepted. The interjection 'Hhayi bo!' was deemed too negative to adequately translate 'Whoops!'. The first translators accepted the suggested 'We!' on condition that the research assistant was informed of the intended meaning so as to use the correct intonation.

The result of this phase of translation was called the Second Consensus (see Appendix C).

3.4.2.4 *Steps five and six*

Table 7: Second blind back-translation and pretesting

Step	People involved	Procedure	Results and discussion
Step five Second blind back-translation to English	The third translators (see Table 9).	The Second Consensus was presented to the third translators They were asked to translate the isiZulu phrases into English. They worked independently without knowledge of the theme of the overlay.	On completion the translations were handed to the researcher who compared them (see Appendix I). The researcher was satisfied that the translation was valid and no further modifications were made.
Step six Pretesting of translation	The ten participants for the pilot study (see Table 12).	The first phase of the pilot study employed Second Consensus. Responses given by participants were investigated in order to determine whether they had understood the translation. They were also asked if they had questions, and to indicate whether they generally understood the task.	The only phrase that needed modification was 'Let us put on...'. The Second Consensus used the translation 'Masendlale...' for this phrase, which is very close to the phrase used for 'Let us make the bed' ('Asendlale umbhede'). All ten participants chose the same symbol for both phrases. Consequently it was decided to use the original 'Maseleke' in the main study. As a further measure of the validity of this phrase, participants were asked individually about the meaning thereof on completion of the first three test sessions. 100 % of those asked could explain the meaning. This confirmed that rural isiZulu-speakers did indeed understand the phrase.

The result was the Final Consensus as found in Appendix C.

Table 8: Description of second translators

	Translator 4	Translator 5	Translator 6
Occupation	Minister and educator near Kranskop	Missionary and shopowner near Kranskop	Missionary and educator near Kranskop
Exposure to Zulu (in years)	25	22	20
Mother tongue	English	German	English and Afrikaans
Other languages	isiZulu, German, Afrikaans	isiZulu, English, Afrikaans	isiZulu, German
Experience with isiZulu to English translation	· 20 years' experience as interpreter during sermons. · Written translation.	· 20 years' experience as interpreter in diverse settings.	· Interpreting during sermons. · Translation in isiZulu Third Language instruction.
Experience with English to isiZulu translation	· Interpreting during sermons.	· 10 years of limited experience.	· Interpreting during sermons. · Translation in isiZulu Third Language instruction.

Table 9: Description of third translators

	Translator 7	Translator 8
Occupation	Educator at ABET adult school near Kranskop	Missionary, educator at ABET adult school near Kranskop
Exposure to English (in years)	20	10
Mother tongue	isiZulu	isiZulu
Other languages	English	English
Experience with isiZulu to English translation	Translation in isiZulu Second Language instruction.	Translation in English Second Language instruction.
Experience with English to isiZulu translation	Translation in isiZulu Second Language instruction.	Translation in English Second Language instruction.

Table 10: Suggestions for the six problem phrases

	Problem phrase (English)	Problem phrase (isiZulu)	Suggestions by Translator 4	Suggestions by Translator 5	Suggestions by Translator 6	Decision by first translators
1	Fold it back	**Kugoqele emuva**	No better suggestion	No better suggestion	No better suggestion	**Kugoqele emuva**
2	Let us put on	**Maseleke**	Agesifake	Faka	Masifake / Masendlale	**Maseleke / Masendlale**
3	Pillowcase	**Iphilo**	No better suggestion	No better suggestion	No better suggestion	**Iphilo**
4	Puff it up	**Uvokomalise**	No better suggestion	Khukhumalisa	Khukhumalisa	**Khukhumalisa**
5	It is nice and soft	**Kuntofontofo**	No better suggestion	Kuntofontofo	No better suggestion	**Kuntofontofo**
6	Whoops!	**Hhayi bo!**	We!	Hawe!	We!	**We!**

3.4.3 Development of test protocol and training of research assistant

A research assistant was selected in collaboration with the principal of the school where the pilot study was performed since she was familiar with all candidate assistants and with the target population. The research assistant was not professionally trained as such, but was deemed suitable because of her proficiency in Zulu and English and because she is indigenous to the Kranskop area. The research assistant is described in Table 11.

Table 11: Description of the research assistant

Mother tongue	IsiZulu
Gender	Female
Age	22 yrs
Highest qualification	Senior Certificate. First year part time student of B Com Business Management at Unisa
Current occupation	Switchboard operator, part time PRO work for two youth organizations
Nature	Friendly, open, spontaneous, quickly establishes rapport with young children, disciplined
Experience with children	Co-rearing eight younger cousins within the area of Kranskop, loves children according to self-report

During the first stages of training the research assistant received general background information and instructions and was presented with the communication overlay, the isiZulu and English phrases. Thereafter the procedure was performed thrice on individual children, as part of training, but also in order to develop a practical test protocol. The research assistant worked from a crude protocol designed by the researcher, and instructions were modified in consultation with the researcher where it seemed necessary. After three sessions it was felt that the research assistant had mastered the procedure and the test protocol was ready to be tested.

3.4.4 Pilot study

Execution of a pilot study is important to ensure the feasibility of planned data collection procedures and suitability of test material. The pilot study was performed in two phases. Participants in the pilot study were selected according to the same selection criteria used for the main study, but were not later included in the main study.

3.4.4.1 Description of participants

Ten participants were tested of which six were females and four males. The mean chronological age was ten years and eight months. The distribution of participants across age (y:m), gender and school is presented in Table 12.

Table 12: Description of participants in the Pilot Study

School	10:0 – 10:3		10:4 – 10:6		10:7 – 10:9		10:10 – 11:0		Total
	F	M	F	M	F	M	F	M	
A	2	0	1	1	1	1	2	2	10

3.4.4.2 *Phase one*

In the first phase of the pilot study the procedure was conducted on ten participants as described in Table 13.

3.4.4.3 *Phase two*

The second phase of the pilot study entailed conducting the procedure a second time on the same ten participants, one week after the first administration. Results were compared in order to establish test-retest reliability. A comparison of the results of the two studies is presented in Appendix N.

Paired t-tests (Steyn, Smit, Du Toit & Strasheim, 1996) were performed on the two groups of data and no significant differences were revealed. It is clear that the procedure was reliable.

Table 13: Pilot Study objectives, procedures, results and recommendations

Objective	Procedure	Results	Recommendations
To determine the number of training items needed to ensure understanding of the task.	Required performance was three consecutive independent correct responses. A correct response comprised first considering all alternatives, then marking the correct one. Ten training items were included, the first three of which were modelled. The number of trials needed for each P to reach requirement was recorded. The mean was calculated and used for the main study.	All P reached required performance within three items.	· Three items should be modelled, whereafter three items should be completed independently by P.
To determine the size of P groups.	Ten P were included and efficiency was monitored.	The group was manageable although firm control was necessary to minimize opportunity for copying.	· Placement of P should be arranged so as to minimize opportunity for copying. · P should be instructed to close their work and not look at the work of others. · R should continually move between P to prevent copying.
To determine the feasibility of the test protocol.	An attempt was made to execute sessions exactly according to the test protocol. Problem areas were identified by the R.	P did not consider all the symbols offered before indicating a choice.	· P should be given approximately 40 seconds per item. · Instructions to look at all the pictures before indicating a choice should be added.
		The RA adapted to the observed needs of the P during sessions and consequently did not execute every session verbatim according to the protocol.	· The RA should be allowed to augment instructions during training where needed, but should use only the protocol instructions during the test procedure.
To determine the validity of the translation.	As mentioned in 3.4.2.4, step six of the translation process was to test whether P understood the translation. Responses given by P were investigated and they were asked general questions after the session, especially about the phrase for 'Let us put on...'.	The only phrase that caused confusion was the phrase for 'Let us put on...'. The Second Consensus used the translation 'Masendlale...' , which is very close to the phrase used for 'Let us make the bed' ('Asendlale umbhede'). All ten P chose the same symbol for both phrases.	· The original 'Maseleke' should be used in the main study. The remainder of the translation should be used unchanged.

(R = researcher, RA = research assistant, P = participants).

3.5 Main study

3.5.1 Participants

3.5.1.1 Participant selection criteria

Participants were selected according to the following criteria:

- Age: Participants had to be between the ages of 10 and 11 years at the time of the survey. The task of selecting a symbol in response to a spoken label has been shown to be one that typically developing ten-year-olds should be able to perform (Daehler, Lonardo & Bukatko, 1979). Thus the possibility of inadequate symbolic representation skills as cause for errors was reduced.
- Mother Tongue: Participants had to be mother tongue speakers of isiZulu.
- Academic Performance: Participants must never have failed a school year. In the absence of formal assessment of mental abilities, this criterion was included to control for severe learning and mental disabilities.
- Grade Level: Participants had to be in grade 4 or 5. In previous years it was common for children in rural areas to start school whenever it was convenient for their parents, albeit earlier or later than the traditional age of six (P. Müller, personal communication, May 30, 2001). This criterion would ensure that participants had largely been exposed to similar learning experiences.
- Sensory Acuity: There had to be no indication of hearing loss or uncorrected sight problems, as confirmed by their teachers. This was screened during the training phase.
- Previous Exposure to PCS: Participants must have had no prior exposure to PCS. Because of the complete absence of therapeutic or special education staff in the Kranskop East Circuit, the probability of exposure was extremely slight (H. Bulcock, personal communication, June 11, 2001).

3.5.1.2 Principles for sample selection

The province of KwaZulu-Natal is divided into eight regions, comprising 41 districts divided further into 196 circuits (P. Müller, personal communication, July 6, 2001). A total of 5792 schools are registered with the KwaZulu-Natal Department of Education and Culture. The twenty-two primary schools in the Kranskop East Circuit were targeted for this study. This

circuit lies south of the Tugela River and east of the village of Kranskop in the Natal Midlands.

The Deputy Chief Education Specialist in Educational Management Information Services (DCES in EMIS) for the region was consulted regarding the size of the target population. Information regarding age, grade and gender of children per school revealed that approximately 600 children met selection criteria (P. Müller, personal communication, May 3, 2001). Information about previous academic performance was not available however, rendering a more accurate estimate of the size of the qualifying group impossible.

A physical map of the Kranskop East Circuit indicated that all schools were located along three main routes. In collaboration with a physical planner from the KwaZulu-Natal Department of Education and Culture – Pietermaritzburg region, schools that would be inaccessible by sedan car were identified, and of the rest, three schools along each of the three routes were chosen. Although an attempt was made to include schools of all sizes, lack of accessibility prohibited the inclusion of any of the very small schools.

Selection of participants at the various schools proved difficult. An elimination sequence of grade level, age, children present at school on the particular day, academic performance and sensory acuity was followed. Age could only be determined by consulting class registers, class teachers and potential participants themselves. In one case birth certificates were available. Since no cumulative records of academic performance existed at any of the schools, information regarding repetition of a grade had to be obtained from each potential participant. This criterion proved to be the most limiting of all and repeatedly disqualified more than half of the potential participants.

Ultimately all children that met selection criteria at the selected schools were included in the study.

3.5.1.3 Description of participants

The nine schools that were selected were all co-educational government-funded schools. None were boarding schools, which means that all the participants were indigenous to the Kranskop East Circuit. None of the schools had facilities for learners with special educational needs. Although the mother tongue of all participants was isiZulu, the language of instruction at all schools was English. The KwaZulu-Natal Department of Education and Culture classifies schools as deep rural, rural, peri-urban and urban, according to no set definitions. Rural is simply described as far from any town, whereas deep rural means 'off the beaten track' (P. Müller, personal communication, July 9, 2001). All schools in the sample were

confirmed to be considered rural or deep rural by the department. A brief description of each school is presented in Table 14.

Table 14: Description of selected schools

School	Lowest grade	Highest grade	Learner total	Description
1	0	7	590	Deep rural
2	0	7	470	Rural
3	0	7	680	Rural
4	0	7	460	Rural
5	1	7	180	Deep rural
6	1	7	230	Deep rural
7	1	7	400	Deep rural
8	1	7	200	Deep rural
9	1	7	700	Rural

From these nine schools a sample of 94 participants were tested of which 52 were female and 42 male. The mean chronological age was ten years and five months. The distribution of participants across age (y:m), gender and school is presented in Table 15.

Table 15: Description of participants

School	10 – 10:3		10:4 – 10:6		10:7 – 10:9		10:10 – 11		Total
	F	M	F	M	F	M	F	M	
1	1	5	3	0	1	1	1	1	13
2	3	3	4	2	1	1	1	0	15
3	2	2	3	2	2	2	1	5	19
4	0	2	0	2	0	0	1	1	6
5	3	1	0	0	0	0	0	0	4
6	0	0	0	0	0	0	4	0	4
7	4	3	7	2	4	2	1	1	24
8	2	1	0	0	0	3	0	0	6
9	2	0	1	0	0	0	0	0	3
Total	17	17	18	8	8	9	9	8	94

3.5.2 Material and equipment

The material and equipment used in this study is presented in Table 16.

Table 16: Material and equipment used

Material / equipment	Use
Communication overlay	A commercially available communication overlay designed by Goossens' et al. (1996) was used. It consisted of 36 PCS symbols selected around the theme of making a bed. The only modification made was to remove all print from the overlay. See Appendix A.
Training overlay	A 36 matrix overlay containing 26 written isiZulu words and 10 line drawings judged by the researcher as being highly guessable to the target population. Used for screening and training purposes. See Appendix B.

Recording booklet	A booklet consisting of 36 A4 facsimiles of the communication overlay as test pages and six of the training overlay as practice pages. Participants were trained to indicate one choice per page.
Final consensus of phrases	The concepts that were represented by the symbols on the overlay were translated into isiZulu (see Appendix C).
Test protocol	The procedure for giving instructions and feedback during the actual testing was read by the research assistant in order to ensure consistency between sessions. The tests protocol included basic instructions for the training phase, which the research assistant augmented where deemed necessary, as well as prompts and praise phrases. See Appendix D for verbatim instructions..
Tokens	Each participant was presented with a plastic, glow-in-the-dark star as reward for participating in the study.
Worksheets	Each participant was provided with a worksheet developed by the researcher as an introduction to AAC and people with LNFS (see Appendix P) Together with discussion of the topic led by teachers, this served as debriefing.
Information to teachers	Teachers were supplied with basic information about severe disabilities and AAC to enable them to lead their classes in discussion while completing the worksheet. See Appendix O.
Markers	Each participant was provided with a marker with which to indicate choice.
Panasonic RQ-L 349 mini tape recorder	70% of sessions were audio-recorded in order to determine the consistency of instructions given across sessions.

3.5.3 Data Collection Procedures

3.5.3.1 General procedural considerations

- Permission to perform the study was obtained from the relevant authorities (see Appendix J).
- The principals of all the primary schools in the Kranskop East Circuit were addressed during a Principals' Meeting on 3 May 2001, where the aims and proposed procedures of the study were described.
- After selecting nine schools for participation, in collaboration with a physical planner from the KwaZulu-Natal Department of Education and Culture – Pietermaritzburg region, the researcher contacted each principal to make arrangements for a visit.
- The researcher and research assistant visited the selected schools personally. On arriving at a school, the first step was to select participants (see 3.5.1.2).
- All participants were divided into groups of ten or less. At one school there were 24 participants and time for only two sessions, so that each session at that school involved twelve participants.
- While selection was in progress, the room designated for the study was being readied. Conditions were similar to that described by Baddeley, Gardner and Grantham-McGregor (1995). Staff was very co-operative but space at the schools was limited. At six schools

classrooms were evacuated in order to accommodate the testing. At the remainder the school kitchen, a half-built classroom and the principal's office were used respectively.

3.5.3.2 *Introduction to session*

- Seats were assigned to the participants so as to minimise the opportunity for copying. While they were taking their seats the research assistant greeted the participants and made them feel at ease. She introduced herself and the researcher and gave each participant an opportunity to introduce him or herself. Both researcher and research assistant were present during the whole of the session.
- Each participant received a test booklet and marker. His/her name and number was written on the first page. The numbers were used to record the seating arrangement of each session.
- At this point the tape recorder was switched on. The introduction was given according to the test protocol (see Appendix D). Participants were given time to look through all the items on the training overlay in silence. They were not allowed to turn the page.

3.5.3.3 *Training procedure*

- After a reasonable lapse of time, when it was clear that all participants had scanned through the items, the research assistant explained the procedure to the participants according to the test protocol (see Appendix D). She read the first word, and repeated it twice after a few seconds. The researcher modelled the desired behaviour, and the participants were urged to copy her: they had to visibly scan through all the possibilities before marking the written form or picture of the word spoken.
- The first three training items were modelled in this fashion. The last three had to be completed independently. The research assistant augmented or repeated the protocol instructions where she deemed necessary.
- The first two training items required the participants to mark written words, the third a picture, the fourth a word, and the last two pictures. In this way the participants were gradually prepared for the test task involving pictures only.
- This procedure served as training in scanning and selection, as well as auditory and visual screening. Participants who failed two or more items were excluded from the study. No participants failed screening.

3.5.3.4 *Testing procedure*

- The research assistant gave instructions for the testing procedure according to the test protocol (for verbatim instructions, see Appendix D). Participants were given time to look through all the items on the communication overlay in silence. They were not allowed to turn the page.
- After a reasonable lapse of time, when it was clear that all participants had scanned through the symbols, the procedure started. The research assistant presented each isiZulu phrase thrice according to a pre-determined random order, and participants marked their choices, one per page. The researcher made sure that participants marked only one block and did not copy from each other.
- The test was not timed since Zulu children are generally not used to speeded performance, rendering a time limit unfair (Bracken & Barona, 1991; Retief, 1988). Furthermore it was important that participants had enough time to consider all the symbols before making a choice, in order to eliminate guessing. Participants were given a reasonable amount of time, until it was clear to the researcher that all participants had marked their choice. She then signalled to the research assistant who introduced the next item. The presence of a very slow or unsure participant could arrest the smooth progression of the test for the whole group, possibly resulting in loss of interest or attention. In such cases, the researcher waited until all other participants had marked choice, then waited several seconds more before giving the signal, regardless of whether the slow participant had marked choice or not. This led to missing data but was deemed necessary to ensure the overall quality of data.
- Five prompts and praise phrases were included in the test protocol (see Appendix D). These were used verbatim by the researcher and research assistant between test items where deemed necessary. No more than one interjection between any two consecutive items were allowed, lest it distracted the attention of the participants.
- Sessions lasted between 45 minutes and one hour. This included greeting, training and testing.
- The session was concluded by the research assistant thanking the participants and giving each a reward, and both researcher and research assistant greeted the participants as they left.
- Worksheets and Information for Teachers were handed to the principal to use at own discretion.

3.5.4 Data analysis and statistical procedures

The researcher captured the data using Microsoft Excel 97. 100% of the captured data were compared to the actual test booklets by a team of four independent individuals. No errors were detected. The data were subsequently analysed by SAS and BMDP Statistical Software using a variety of statistical procedures, as discussed in Table 17.

Table 17: Statistical procedures employed

Statistical procedure	Use
Paired t-test (Steyn et al., 1996)	The data from phase one and two of the pilot study were compared to reveal significant differences.
Descriptive statistics	Due to the discrete nature of the data, frequency distribution counts were used extensively. The mean of correct responses across symbols and standard deviation were also calculated.
Chi square variance test	The performance of males and females were compared to reveal significant differences.

3.5.5 Consistency

To ensure that the presentation of instructions for the test procedure was consistent across sessions to ensure that all participants received the same amount of clarification and motivation, the instructions of 9 out of 13 sessions (70%) were played back to Judge 3 after the completion of data collection. A checklist comprising all the instructions from the test protocol was used to record which instructions were used and which were left out or modified (see Appendix E). Consistency was computed by dividing the number of instructions used correctly, by the number of sentences that should have been said for each session. An average across sessions was then computed. Accordingly, consistency across sessions was 94% (range = 80%-100%). These figures would have been higher was it not for the frequent omission of the sentence telling participants not to write before the signal was given. It is argued that the omission of this sentence would not have affected the performance of participants.

3.6 Summary

This chapter presents the methodology used in the study. The aims and sub-aims are stated and a brief description of the research design is presented. A discussion of the preparatory phases outlines the selection of an appropriate communication overlay, the translation of the labels, and training of a research assistant. An account of the pilot study is given, including recommendations for the main study. The main study is discussed according to participants involved and materials and equipment used. Methods of data collection and analysis are also presented.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

In this chapter the results of the study are described and discussed according to the objectives set out in Chapter 3. The frequency of correct responses per label will be presented. An analysis of errors will be presented and discussed. Finally possible influences on correct responses will be considered.

The entire body of data is presented in the form of a matrix in Appendix Q. Note that the columns present *symbol numbers* and the rows *presentation numbers*. The use of these two phrases needs to be clarified since it will be referred to throughout the discussion.

The *symbol numbers* were determined randomly by retrieving the 36 individual symbols one by one from a bag. The symbol that was retrieved first was numbered 1, the second symbol retrieved was numbered 2 etc. To simplify the test procedure, symbol labels were presented in this order, so that the label for symbol 1 was presented first, the label for symbol 2 was presented second and so forth. *Presentation numbers* therefore refer to the order in which labels were presented.

4.2 Missing data

There were three sources of errant data:

- It was mentioned in 3.5.3 that although the testing procedure was not timed, the researcher did not allow unusually slow participants to hinder the flow of the testing. No more than 40 seconds was allowed per item. In most instances the prompt 'okay…turn the page' from the research assistant induced the slower participants to select a symbol, but some turned the page without indicating a choice. Such instances were coded as 'no response'.
- In spite of the vigilance of the researcher, it happened five times that participants marked two symbols on one page in response to a single label. Such responses were likewise coded as 'no response' since they could not be used.
- The activity graphic in the top right hand corner of the communication overlay was not removed from the overlay since it does not constitute print. Although this block was not mentioned or pointed to during training, some participants marked it as a choice on some occasions. For coding purposes the activity graphic was assigned the number 50.

In eight instances participants clearly cancelled their first choice of a symbol and marked another one. The second choice was used in calculations.

From Table 18 it is clear that missing data had the greatest influence on presentation numbers 1, 3, 14 and 17. Since only symbols that were indicated by nineteen or more participants are discussed in this paper, the influence of the missing data was deemed negligible.

Table 18: Missing data

Presentation Number	1	2	3	13	14	17	20	21	22	26	28	30	Tot
Frequency of 50	0	0	0	0	2	5	0	1	0	0	0	1	9
Frequency of no response	3	1	3	1	1	0	1	0	1	1	1	0	13
Percentage out of 94 (number of participants)	3,2	1,0	3,2	1,0	3,2	5,3	1,0	1,0	1,0	1,0	1,0	1,0	-
Percentage out of 3384 (participants x symbols)	0,09	0,03	0,09	0,03	0,09	0,14	0,03	0,03	0,03	0,03	0,03	0,03	0,65

4.3 Correct responses

Doherty et al. (1985) mention two types of transparency scores: subject scores, where each participant's accuracy in guessing the meaning of symbols is computed; and iconicity values, where the number of participants that responded correctly to each item is counted to represent each symbol's guessability. Iconicity values were the focus of this study, and are presented in Figure 3.

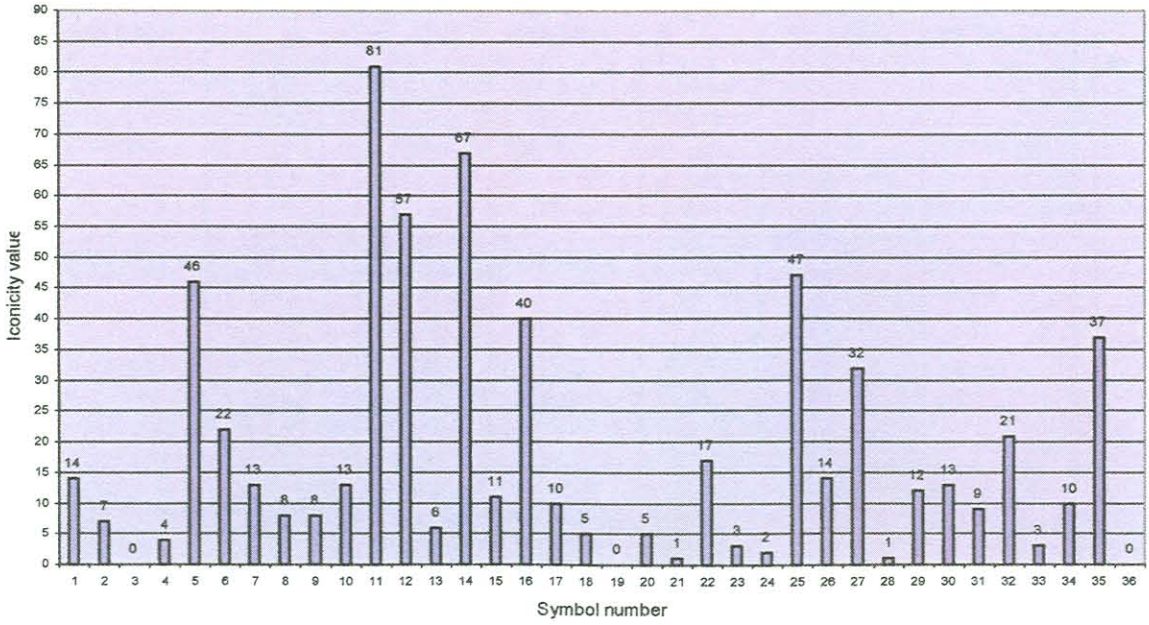
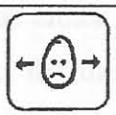
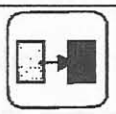
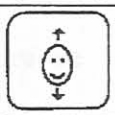
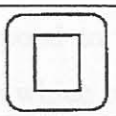
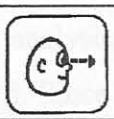
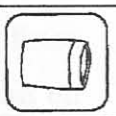
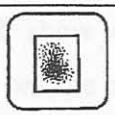


Figure 3: Correct responses per label

Table 19 visually presents the presentation order of labels and frequent reference to this table throughout the discussion will aid interpretation.

Table 19: Presentation order of the labels

Pres Nr	Label in English	Target symbol	Pres Nr	Label in English	Target symbol	Pres Nr	Label in English	Target symbol
1	What is next?		13	It is finished.		25	Puff it up.	
2	It is nice and soft.		14	Let us make the bed.		26	What a mess!	
3	No.		15	Thank you.		27	It looks like a bomb went off.	
4	You need to change them.		16	...the blanket.		28	Let us do it again.	
5	Whoops!		17	Let us put on...		29	Yes.	
6	We forgot.		18	...the sheets.		30	Put it here.	
7	What do you think?		19	Where is it?		31	You are welcome.	
8	It is nice and clean.		20	Look at this.		32	...the pillow case.	
9	Let us take it off.		21	Tuck it in.		33	Let me...	
10	It is crooked.		22	It is dirty.		34	It looks bad.	
11	You need to pull.		23	Fold it back.		35	Hold this, please.	
12	Put it in the tub.		24	Help me, please.		36	It looks good.	

(Pres Nr = Presentation number)

Doherty et al. (1985) used strict (iconicity values ≥ 75%) and lenient (iconicity values ≥ 50%) criteria for interpreting the transparency scores of Amer-Ind gestures. Although the present study did not investigate pure transparency, these criteria were nevertheless deemed useful.

lues. Accordingly, one symbol (symbol 11 []) was found to be iconic when the strict criterion was applied, and four symbols (symbols 11; 12 []; 14 []; and 25 []) when the lenient criterion was applied. Note that symbol 5 [] achieved an iconicity value of 49% (n=46) and was one vote short of being classified as iconic according to the lenient criterion. When the very liberal criterion (iconicity values ≥ 25%) of Hoemann (1975) was applied, eight symbols emerged as iconic (symbols 5; 11; 12; 14; 16 []; 25; 27 []; and 35 []). Thus either 2,8% or 11,1% or 22,2% of the symbols on the communication overlay were iconic for the participants involved, depending on the criterion used. The average of correct responses across all symbols was 17,75 (18,88%) with a standard deviation of 20,17. Table 20 shows a ranking of symbols according to their iconicity values. It is clear that this collection of symbols was largely non-iconic for the participants involved. Error responses might shed valuable light on how symbols are viewed, and will therefore be examined closely in the following section.

4.4 Analysis of errors

All responses are presented in the form of a matrix and visually in the form of a graph in Appendix Q. From this it is clear that error patterns can be examined from two viewpoints. The columns correspond to the 36 symbols, so that analysis per column will reveal those labels in response to which each symbol was indicated. Since such an analysis will focus on how participants viewed each symbol, symbol variables such as complexity and iconicity (Fuller & Lloyd, 1991; Fuller, 1997) will have to be investigated. Conversely, the rows correspond to the 36 labels, and analysis per row will show which symbols were chosen in response to each label. The focus of such an analysis will be on how participants interpreted each label, and referent variables (Luftig, 1983; Fuller & Lloyd, 1991; Fuller, 1997) such as concreteness vs abstractness and frequency of occurrence of the label will need to be considered. Since this study is concerned with the iconicity of symbols, the analysis of error patterns was done per column. However, a summary of analysis per row is presented in Appendix R.

Table 20: Ranking of symbols in intervals of percentage correct responses

Interval	Symbols and English phrases				
50% and over	You need to pull (n=81) 	Let us make the bed (n=67) 	Put it in the tub (n=57) 	Puff it up (n=47) 	
40% - 49%	Whoops! (n=46) 		...the blanket (n=40) 		
30% - 39%	Hold this, please (n=37) 		It looks like a bomb went off (n=32) 		
20% - 29%	We forgot (n=22) 		...the pillow case (n=21) 		
10% - 19%	It is dirty (n=17) 	What is next? (n=14) 	What a mess! (n=14) 	What do you think? (n=13) 	It is crooked (n=13) 
	Put it here (n=13) 	Yes (n=12) 	Thank you (n=11) 	Let us put on... (n=10) 	It looks bad (n=10) 
0% - 9%	You are welcome (n=9) 	It is nice and clean (n=8) 	Let us take it off (n=8) 	It is nice and soft (n=7) 	
	It is finished (n=6) 	...the sheets (n=5) 	Look at this (n-5) 	You need to change them (n=4) 	
	Fold it back (n=3) 	Let me... (n=3) 	Help me, please (n=2) 	Tuck it in (n=1) 	
	Let us do it again (n=1) 	No (n=0) 	Where is it? (n=0) 	It looks good (n=0) 	

4.4.1 Analysis per column

When the highest frequency responses were studied for each symbol, it became clear that for some symbols a considerable number of the participants agreed on a single specific label, be it the target label or a non-target label. For other symbols either many possible labels, or none were indicated. The term 'distinctiveness' was coined to describe how well-defined or specific the evoked meanings were that a symbol triggered in the mind of a viewer. This term should not be confused with 'perceptual distinctness' as described by Fuller, Lloyd & Stratton (1997). According to them perceptual distinctness refers to the degree to which the symbols in a group are clearly different or distinct from one another.

It is also important to note that 'distinctiveness' was not intended as an equivalent to 'iconicity'. Whereas both terms concern the visual relationship between a symbol and its referent, they indicate different aspects of that relationship. Iconicity pertains to the degree of visual similarity perceived, as demonstrated by the use of the three dimensions transparency, translucency and opaqueness (Fuller & Lloyd, 1991; Blischak et al., 1997). The term distinctiveness as used in this study, relates to the specificity of visual similarity perceived – whether participants perceive similarity to one referent, or to many or none.

Iconicity is measured by determining the frequency correct responses on a stimulus, which means that symbols can be described as 'more' iconic or 'less' iconic. It is clear that iconicity can be described as a continuum. Distinctiveness, as used in this study, is measured by investigating the distribution of all responses on a stimulus. Only the strongest responses are considered, so that a symbol can either be distinctive (evokes one meaning above criterion) or indistinctive (evokes more than one meaning or none above criterion). Due to the exploratory nature of the present study, the criterion used was arbitrarily selected. The subsequent classification of symbols allowed for no degrees of distinctiveness between the points of 'distinctive' and 'indistinctive'. This treatment of the variable does not exclude the possibility that it should by right also be placed on a continuum where symbols can be described as 'more' distinctive and 'less' distinctive. Such classification would be necessary if not only the pattern of distribution of responses are considered as in the present study, but also the strength or intensity of responses.

Since iconicity and distinctiveness are not opposing terms, a symbol can simultaneously be low in iconicity and distinct, as when few participants guess a symbol in response to the target label, but many of them choose it in response to a non-target label. A symbol can also be high in iconicity but indistinct, as when many participants choose a symbol in response to the intended label, but also in response to one or more other labels. Similarly a symbol can be classified as low in iconicity and indistinct, and high in iconicity and distinct.

The symbols from the present study were distributed across the four orthogonal groups: distinctive x more iconic; distinctive x less iconic; indistinctive x more iconic; and indistinctive x less iconic. To determine iconicity and distinctiveness two criteria were used. Regarding the iconicity of a symbol, the criterion suggested by Hoemann (1975) was used (iconicity values ≥ 25%). Admittedly this criterion is very lenient (Lloyd et al., 1985), but since this analysis was concerned with relative rather than absolute iconicity, it was considered appropriate. To describe distinctiveness, all response frequencies ≥ 20% were

investigated. Note that this cut-off point was arbitrarily selected and not statistically determined.

The distribution of the symbols from the present study across these four orthogonal classifications is presented in

Table 21.

Table 21: Distribution of symbols according to iconicity and distinctiveness

	More iconic (iconicity values ≥ 25%)	**Less iconic** (iconicity values < 25%)
Distinctive (only one response over 20%)	5; 12; 16; 25; 27; 35	4; 7; 13; 15; 20; 26; 28; 31
Indistinctive (More than one response over 20%, or no responses over 20%)	11; 14	6; 18; 32; 33; 1; 2; 3; 8; 9; 10; 17; 19; 21; 22; 23; 24; 29; 30; 34; 36

A discussion of symbols according to this classification follows.

4.4.1.1 Distinctive x more iconic

Symbols 5 []; 12 []; 16 []; 25 []; 27 []; 35 [] fell under this classification. This is no surprise since each of these symbols was indicated as iconic in the previous analysis. This analysis reveals that participants perceived a relatively strong visual relationship between these symbols and their target referents, and to those referents alone.

4.4.1.2 Indistinctive x more iconic

Two symbols were classified as indistinctive x more iconic, namely symbols 11 [] and 14 []. These symbols were indicated as the two most iconic symbols in the previous analysis. It is evident however that participants perceived visual similarities between these symbols and not only their target referents, but also other referents.

Symbol 14 (iconicity value=67) was chosen the most in total (n=214) and 15 participants selected it more than three times during the procedure (see Figure 4). The 147 error responses were distributed across 22 of the 35 non-target phrases, with the highest frequencies in response to the labels 'It is nice and soft' (n=28); 'Let us put on…' (n=25) and 'You need to change them' (n=19). It is clear that symbol 14 was highly indistinctive to participants.

A discussion of the perceptual features of the symbol and conceptual features of its label (Bloomberg et al., 1990) may shed some light on this observation. Perceptually symbol 14 depicts a human figure in front of a bed, with motion implied by postural cues in the figure

such as three bent limbs and a tilted head. These perceptual features should be easily identified. According to Friedman and Stevenson (1975) ten-year-old children interpret postural cues (where the posture of the figure deviates from the still position) efficiently as implying two-dimensional motion. Moreover, stick figures like the one in the symbol are generally well understood (Martlew & Connolly, 1996). The fact that this symbol is classified as iconic confirms that these features were easily recognised. From previous experience participants had adequate knowledge of this situation to link the perceptual information to the concept of making a bed.

The question remains why participants selected symbol 14 so often in response to other labels as well. This might possibly be explained by the fact that the conceptual features of the label 'Let us make the bed' were exceptionally close to the theme of the overlay. Pit is possible that underlying conceptual similarities existed between this label and the labels of some of the other symbols. All the non-target labels that were frequently associated with this symbol directly concern the action of making a bed and therefore support the notion of underlying conceptual similarities. It is postulated that the indistinctiveness of symbol 14 can be ascribed to the context in which it was presented, and that had this symbol been presented in a group of unrelated foils like in most other iconicity studies, it probably would have scored higher on distinctiveness.

The perceptual features of symbol 11 (iconicity value=81) include a human figure in implied motion and an object linked to the figure by rope. Two non-target labels were associated with this symbol by more than 20% of participants respectively: 'Let us take it off' (n=36) and 'What is next?' (n=21). The conceptual features of the label 'You need to pull' include a person, an object and movement in the direction of the person. The same can be said of the label 'Let us take it off', and therefore the confusion of the two labels for symbol 11 seems reasonable. The label 'What is next?' implies movement of a more abstract kind: from the present to the future. The target symbol for this phrase, symbol 1 [] indicates this movement with an arrow. The fact that symbol 11, where postural cues indicate movement, was preferred to symbol 1, suggests the possibility that participants did not make optimal use of the arrow as presenting information about movement.

It could be mentioned here that seemingly the question mark in symbol 1 was also not optimised by participants. Three of the symbols in the collection contained question marks: symbol 1, symbol 7 [] and symbol 19 []. It is postulated that if participants recognised and optimally utilised the question mark, they would have associated one these

symbols with the label 'What comes next?' since it is a question. Yet they most often associated a symbol that has no question mark (symbol 11). Unfamiliarity with punctuation marks was ruled out as a cause for this since participants had four to five years of schooling prior to testing.

4.4.1.3 Distinctive x less iconic

Table 22 is a summary of the symbols that fell under this classification.

Table 22: Symbols classified as distinctive x less iconic

Symbol number	Label	Symbol	Most frequent error label	Frequency
4	You need to change them.		What a mess!	19
7	What do you think?		Look at this.	29
13	It is finished.		No.	30
15	Thank you.		We forgot.	27
20	Look at this.		What do you think?	22
26	What a mess!		It is dirty.	19
28	Let us do it again.		It is crooked.	36
31	You are welcome.		It is finished.	39

For most symbols the frequently associated non-target labels can be motivated. Symbol 4 [] intends to depict a change of colour, but might also be interpreted as a change from clean to dirty, possibly accounting for the confusion with the label 'What a mess!'. If this explanation is accepted, it seems that participants did interpret the arrow in this symbol as indicating change.

Participants seem once again not to have made optimal use of the question mark in symbol 7 [], since they associated it with a label that was not a question. This appears to confirm the observations made in 4.4.1.2. The association of this symbol with the label 'Look at this' can possibly be clarified by assuming that the pointing finger in symbol 7 had been interpreted as indicating where to look. It is interesting to note that the direction of the two actions differ. The phrase 'What do you think?' implies observation in the external world leading to contemplation in the mind, so that the action is from external to internal (as symbol 7 indeed points out). Conversely the phrase 'Look at this' refers to the intention to look at

something whereupon gaze is directed in the external world, an action from internal to external, as seen in symbol 20 []. The fact that 'Look at this' was associated with symbol 7 might indicate that participants did not adequately utilise the directional quality of the pointing finger and the arrow in the symbols.

In this regard it is interesting to note that symbol 20 was associated in turn with the label 'What do you think?'. This can possibly be explained by examining language differences. The isiZulu phrase 'Ubona kanjani?' is the equivalent of 'What do you think?' but if translated literally means 'How do you see it?' (see Appendix H). Note that in this case the difference in direction of actions involved is imbedded in the fact that two languages are used. The English phrase 'What do you think?' suggests an external to internal action as discussed above, while the equivalent isiZulu phrase 'How do you see it?' implies an internal to external action. Thus the fact that participants selected symbol 20 [] in response to the label 'What do you think' is not surprising. It appears that they did in fact interpret the perceptual properties of symbol 20 as depicting the action of looking or seeing, but linked it to a non-target phrase that were to them conceptually close to the symbol.

To viewers that are unfamiliar with American Sign Language (ASL), symbols 13 []; 15 [] and 31 [] might be difficult to understand. The top hand in symbol 13 might be interpreted as showing the viewer a flat palm with fingers nearly pointing upward. This sign is typically interpreted as 'stop' or 'enough', and in the absence of these labels the closest alternative might have been 'No'.

Symbol 15 shows two hands on the chin of a face. The label 'We forgot' was associated with this symbol, possibly because people who are shocked or surprised sometimes put their hands over their mouths. If this interpretation is accepted, participants once again did not use information afforded by the arrows pointing outwards. Two arguments can be put forward. Either participants did not regard the arrows as showing movement, or they did not optimise the directional information afforded by it. They might have interpreted it as showing that the hands move towards the chin, confirming the observations made in 4.4.1.2.

Symbol 31 depicts two hands with empty palms turned upwards. If the hands were motionless in that position, it could be interpreted as showing that the hands are empty, possibly explaining why the label 'It is finished' was associated. The arrows however imply movement away from the face, a clue that was presumably not optimised by participants.

Symbol 26 [] was associated with the label 'It is dirty', seemingly due to corresponding conceptual features of this label and the target label 'What a mess!'.

Symbol 28 [] was associated with the label 'It is crooked'. This observation can be interpreted as meaning that the directional quality of the two arrows was not optimally utilised. The arrows were rather seen as two lines that are not straight. This once again confirms the hypothesis that participants did not make optimal use of the direction indicators or arrows in the symbols.

4.4.1.4 Indistinctive x Less iconic

This classification included two conditions: symbols with iconicity values < 25% and more than one error response ≥ 20%; as well as symbols that had no responses ≥ 20%.

Symbols from the first condition are presented in Table 23. Note that correct responses are not included in the discusssion that follows.

Table 23: Symbols classified as indistinctive x less iconic

Symbol number	Label	Symbol	Iconicity value	Frequent error label	Frequency of frequent error
6	We forgot.		22	Let me...	20
18	...the sheets.		5	It is nice and soft.	20
				Let us make the bed.	24
32	...the pillow case.		21	...the sheets.	21
33	Let me.		3	Thank you.	32
				Let us fold it back.	22

Symbol 6 [] was indicated 20 times in response to 'Let me…' whereas the target symbol for that label, symbol 33 [] was indicated only three times. It is possible that participants interpreted the thumb in symbol 33 as pointing to the back of the figure and not to him, whereas the hands in symbol 6 clearly touch the figure.

This hypothesis is supported when the error responses for symbol 33 are considered. It was selected 22 times in response to 'Let us fold it back', indicating that participants did indeed interpret the thumb as pointing to the back of the figure. Symbol 33 was also selected often in response to 'Thank you'. The reason for this is unclear. In the light of what has already been said about the direction of indicators (see 4.4.1.2 and 4.4.1.3), the likelihood exists that

participants interpreted the thumb as pointing upwards. This 'thumbs up' sign is used commonly among Zulus, often accompanied by the exclamation 'Sharp!', to indicate satisfaction. In the absence of that label, 'Thank you' may have been the closest alternative.

The labels with which symbol 18 [] was associated most often ('It is nice and soft' and 'Let us make the bed') need little explanation. A bed is typically soft, and beds need to be made. Symbol 14 [] drew 67 of the responses when the label 'Let us make the bed' was presented, and symbol 18 drew 24. The activity graphic (symbol 50 []) drew two responses and one response was missing. Thus all responses to this label were concentrated on the three symbols on the overlay that depicted beds. Symbol 14 proved more illustrative of this label than the other two. This might be due to the fact that symbol 14 included a human figure in implied motion (as discussed in 4.4.1.2). The referent 'Let us make the bed' falls under the verb category and participants might have reasoned that the symbol showing action is the most appropriate match for the label. It appears then that participants used the information about movement offered by postural cues optimally. It can also be argued that symbol 14 was selected more often because it offered the most information: it contained a figure and some 'sheets' as well as a pillow on the bed, whereas symbol 18 showed only a bed and a pillow.

Symbol 32 [] was as often indicated in response to the label '… the pillow case' as to the label '…the sheets'. It is possible that participants interpreted this symbol as resembling a pillowcase and sheets equally well. Alternatively, the following argument can be made. Participants perceived symbol 18 [] as fairly non-iconic (n=5), so that the overlay lacked a symbol that showed strong visual similarities to the referent 'sheets'. Participants were in essence forced to choose a symbol on grounds other than visual similarity. They could have argued that symbol 32 clearly depicted a pillow case, that '…pillow case' belonged to the same semantic category as '…the sheets' (namely bed linen), consequently symbol 32 would be the best possible choice. This argument is strengthened when it is noted that symbol 16 [] (which also belongs to the category of bed linen) was chosen 18 times in response to '…the sheets'. These observations illustrate again how the fact that all alternatives were related to each other, influenced the performance of participants.

Symbols 1 []; 2 []; 3 []; 8 []; 9 []; 10 []; 17 []; 19 []; 21 []; 22 []; 23 []; 24 []; 29 []; 30 []; 34 []; 36 [] showed low iconicity and no other peak responses. It seems that participants perceived no strong visual relationship between these symbols and any of the labels. In an attempt to understand these responses, symbols were grouped according to unifying factors and these groups will be discussed.

It was hypothesised that symbols 2; 8 and 22 offered too little information to allow participants to make a judgement. Interestingly all three referents are adjectival phrases with the purpose of describing an attribute of an unknown noun. Bloomberg et al. (1990) found adjectival modifiers to be generally less translucent than nouns across five graphic symbol systems, of which PCS was one. They argue that modifiers depict a specific attribute of a noun, and that in order to interpret such symbols correctly one must know which attribute to focus on lest the whole noun is taken as the referent. It is likely that symbols 2, 8 and 22 were expressly designed not to include recognisable objects in order to draw attention to the attribute that is to be described. For example, it is unclear whether symbol 2 [] represents a piece of cotton wool, a piece of dough or a cloud. Yet all these objects share the quality of softness, which is what symbol 2 intends to represent. Thus the object is unspecific or generic so that the viewer will not focus on the whole object, but on the attribute that is to be described. Likewise the rectangles in symbols 8 [] and 22 [] do not correspond well to any one object and can as a result represent any object. It is hypothesised however that these attempts at using generic objects, instead of guiding participants to focus on the relevant attribute namely softness, cleanness or dirtiness, decreased the informational value of the symbol to the extent that no meaning could be made of it. A wide variety of labels were infrequently associated with these symbols, supporting the notion that participants did not assign meaning to these symbols but rather selected them haphazardly.

Symbol 34 [] is an adjectival modifier that does show a very specific object, namely a face. Unlike most adjectival modifiers, it is not a specific attribute of the face that should be focused on to arrive at the referent. The referent is not, for example, 'It is closed' in which case the closed eyes would be the specific attribute. Rather, the face shows how one could react to the referent ('It looks bad'). This reaction would vary between cultures and between situations within cultures, which possibly accounts for the erratic way in which this symbol

was selected. It is possible that the participants in this study felt inhibited because of the protruding tongue. Zulu children are generally taught that it is rude to stick out one's tongue.

Cultural differences can probably also account for the infrequent selection of symbol 36 []. This sign is not used by Zulu people, so that even if they recognised that the symbol contained a hand held in a certain way, they were not able to link these perceptual features to the concept of 'good'.

Symbol 10 [] is an adjectival phrase that uses an arrow to point to the specific attribute to be focused on. Despite this clue participants still could not guess the target meaning of the symbol. This is once again offered in support of the possibility that participants did not make optimum use of the indicators in symbols.

This notion is further supported by symbols 1 []; 3 []; 9 []; 19 []; 21 []; 23 [] and 29 []. All of these symbols contain arrows. It is possible that the presence of arrows is not related to the low iconicity and indistinctiveness of these symbols. If however the evidence collected thus far is considered as a whole, it seems that the arrows could have been a cause of the low iconicity and indistinctiveness. For example, none of the symbols indicated as iconic contained arrows, and only five symbols containing arrows did not fall in the present classification. These are symbols 4 []; 13 []; 15 []; 20 [] and 31 []. It has already been shown that the arrows in symbols 13; 15; 20 and 31 were not interpreted optimally. The information yielded by the arrow in symbol 4 was used optimally (see 4.4.1.3). It seems then that participants failed to optimally extract meaning from the arrows contained in all symbols except one.

Symbols 17 []; 24 [] and 30 [] evidently did not evoke strong meaning for participants. The reason for this is not clear.

4.5 Possible influences on results

Three factors were investigated for possibly influencing the results, namely the total frequency of selection of symbols; the position of symbols on the communication overlay, which include a qualitative analysis of word classes; and the gender of participants.

4.5.1 Total frequency of selection of symbols

The methodology required only one choice per page, to ensure that all 36 symbols were available every time a participant had to make a choice. Consequently the possibility existed for a single symbol to be indicated in response either to more than one label, or to none. A frequency procedure showing how often each participant chose each symbol was performed on the data. This revealed that participants selecting certain symbols twice or thrice was common, and that in one case a symbol was selected up to nine times by one participant. Table 24 shows the distribution of such recurrences and Figure 4 presents it graphically.

Table 24: Distribution of recurrences

Symbol number	5	6	7	11	12	13	14	15	16	17	20	22	26	31
9 times	-	-	-	-	-	-	-	-	-	-	-	-	-	1
6 times	-	-	-	-	-	-	1	-	-	-	-	-	-	1
5 times	-	1	2	-	-	1	2	-	-	-	-	1	1	1
4 times	1	3	1	1	2	4	12	2	1	3	1	-	-	8

It was hypothesised that the more a symbol was selected, the higher the frequency of correct responses would be. To test this, the total frequency of selection per symbol (Figure 5) and the frequency of correct responses per symbol (Figure 6) were plotted on the same chart and compared (Figure 7).

It is evident that there is no relationship between the two sets of data to support the hypothesis. It can be concluded that the frequency of correct responses is not a function of total frequency of selection of symbols. Total frequency of selection may however reveal valuable insight into how certain symbols are viewed, as discussed in earlier sections.

4.5.2 Position of symbols on communication overlay

The possibility exists that participants were influenced in their choosing of symbols by factors such as placement on the periphery or in the centre of the overlay. It was hypothesised that symbols on the periphery could draw more attention because of less competing stimuli surrounding them. Conversely it could be supposed that the four symbols in the centre of the overlay would draw more attention because viewers focus there first. A further possibility would be for participants to concentrate on the symbols in the top left quadrant of the overlay. Fonseca and Lassey (1964, in Duncan et al., 1973) found that literate individuals preferred the top left quadrant of a page.

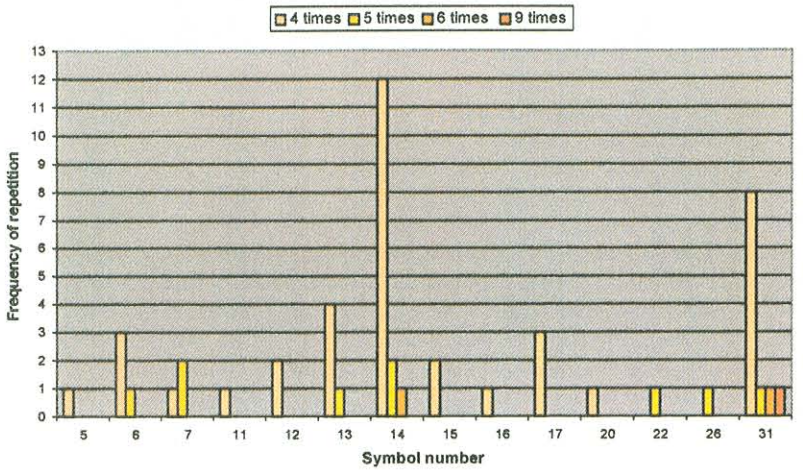


Figure 4: Distribution of recurrences

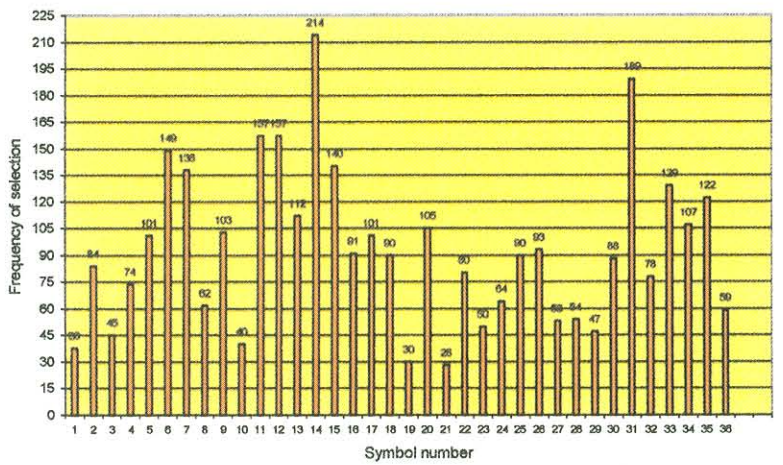


Figure 5: Total frequency of selection of symbols

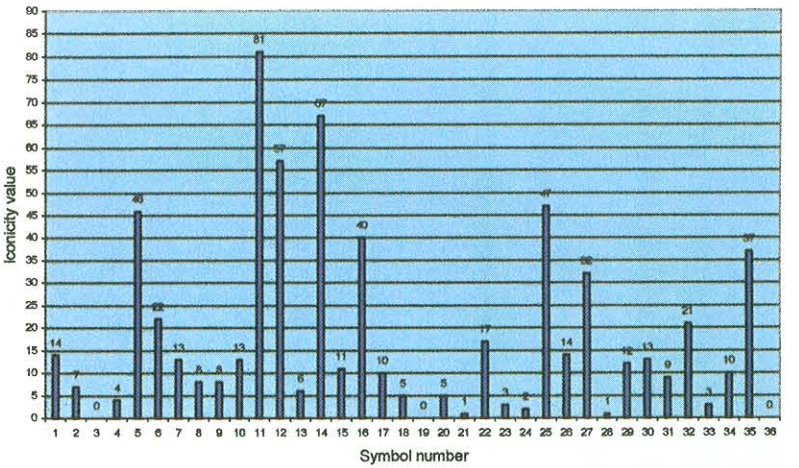


Figure 6: Correct responses per symbol

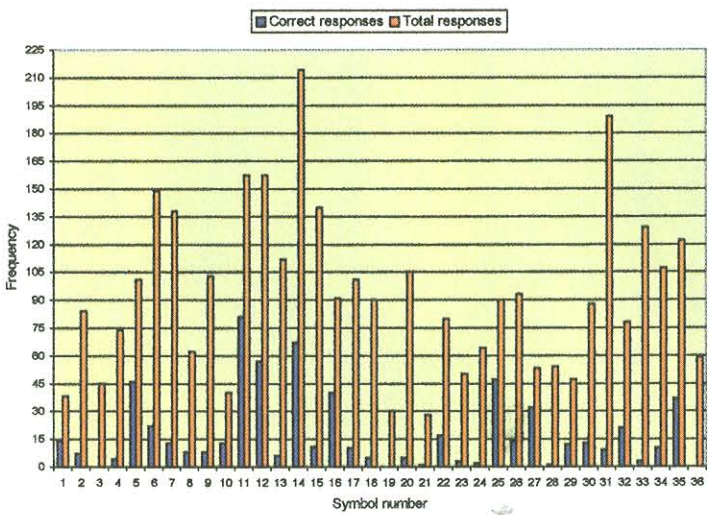


Figure 7: Correct responses and total frequency of selection

A qualitative analysis was performed in order to reveal possible patterns. The analysis entailed shading the blocks of a matrix-36 with differing intensities to indicate higher and lower frequencies of selection as a function of position on the overlay. This was done once for the total frequency of selection (see Figure 9) and once for frequency of correct responses (see Figure 10). Darker cells indicate the position of a higher frequency and lighter cells indicate the position of a lower frequency. The key gives specific frequency information. Figure 8 serves as a general summary of the placement of symbols, total frequency of selection and frequency of correct responses per symbol. It is intended as a quick reference for the interpretation of Figure 9 and Figure 10.

This presentation reveals that symbols placed on the periphery, the centre and the top left quadrant of the overlay were neither selected more often in total nor more often in response to the correct label. It seems that physical placement did not influence selection.

Another factor related to position could have influenced the choices of participants. To facilitate efficiency, the symbols on various communication overlays are consistently grouped according to grammatical categories namely Social (S) (pronouns, Wh-words, exclamation words and negative words), Verbs (V), Descriptors (D) (adjectives and adverbs), Prepositions (P) and Nouns (N) (Goossens' et al., 1992). The key concept of each sentence/phrase on the overlay serves as a basis for dividing the symbols into these categories. Symbols belonging to the same category are placed together so that they can be colour coded for easy access. Each overlay is therefore roughly divided into five columns, with all Social symbols placed to the very left of the overlay, followed by Verbs, Descriptors, Prepositions, and Nouns to the very right of the overlay. The letters next to the symbols in Figure 8, as well as dividing borders in Figure 9 and Figure 10, indicate these categories.

Previous studies investigating the comparative iconicity of grammatical categories showed that modifiers are the least iconic word class. Results regarding verbs and nouns are inconclusive. Luftig et al. (1983) found verbs significantly more translucent than nouns, while Mizuko (1987) found that for PCS nouns and verbs had very similar transparency values, with nouns achieving slightly higher scores. Bloomberg et al. (1990) found that nouns were more translucent than verbs across five graphic symbol systems, including PCS. Since word classes were arranged topographically, information about iconicity as a function of position on the overlay would simultaneously yield information about iconicity as a function of grammatical category.

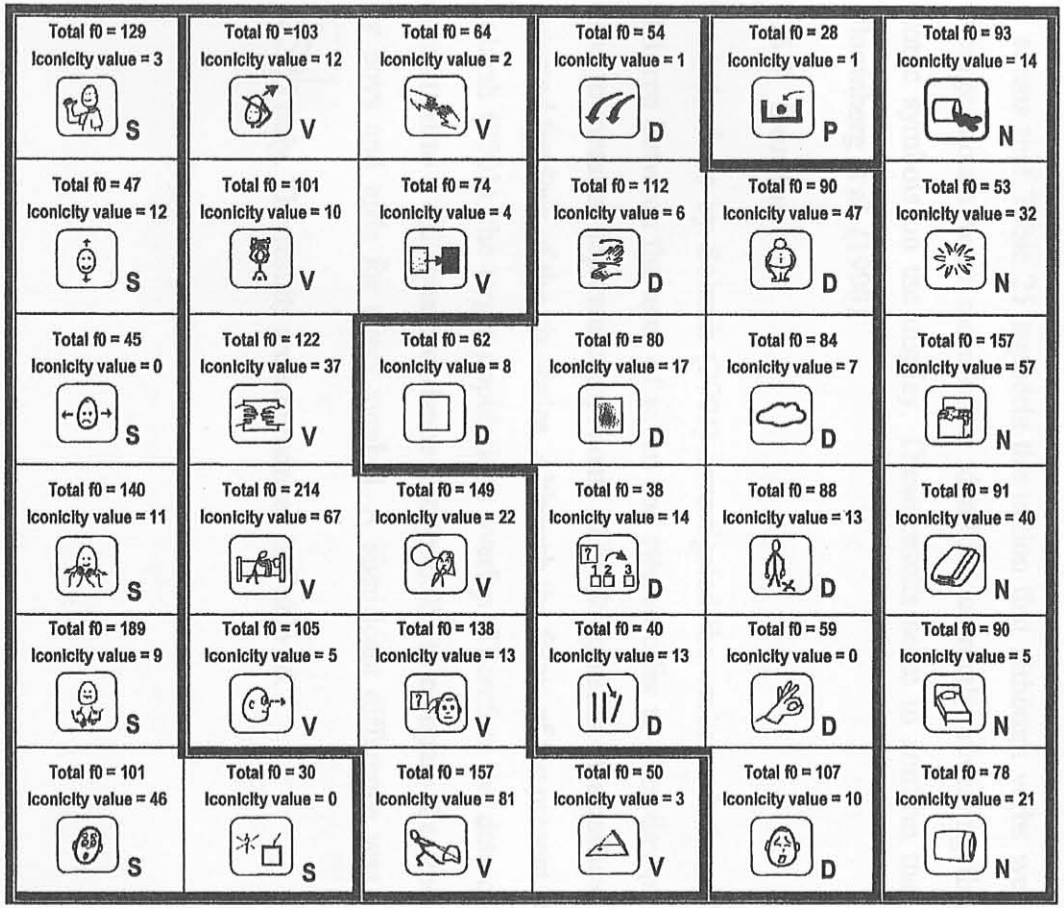


Figure 8: Total frequency of selection and iconicity value of each symbol as positioned on overlay

Key:

S = Social words
V = Verbs
D = Descriptors
P = Prepositions
N = Nouns
f0 = frequency

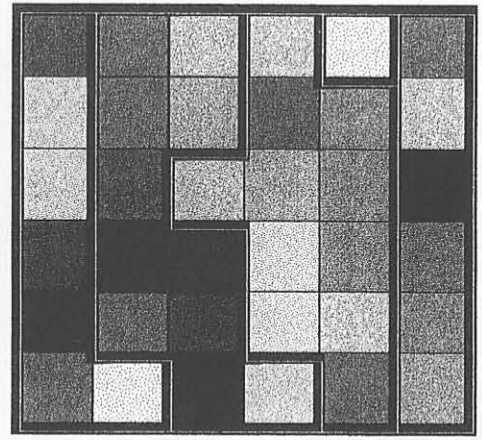


Figure 9: Total frequency of selection

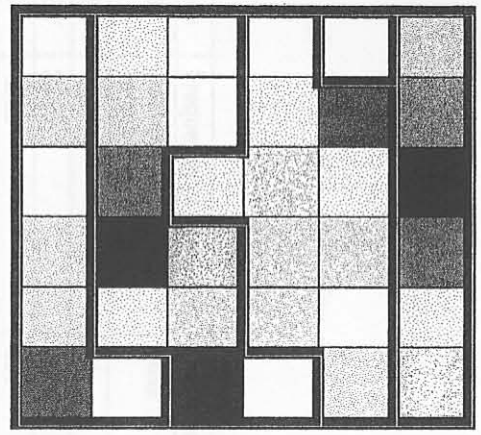


Figure 10: Frequency of correct responses (iconicity values)

Key:

A		B
11-20		0-4
21-30		5-8
31-40		9-12
41-50		13-16
51-60		17-20
61-70		21-24
71-80		25-28
81-90		29-32
91-100		33-36
101-110		37-40
111-120		41-44
121-130		45-48
131-140		49-52
141-150		53-56
151-160		57-60
161-170		61-64
171-180		65-68
181-190		69-72
191-200		73-76
201-210		77-80
211-220		81-84

- A= Total frequency of selection
- B= Frequency of correct responses (iconicity values).

When grammatical categories from this study are investigated (see Figure 10) it appears that as a group, nouns were correctly indicated more often than other categories. Admittedly the two symbols with the highest iconicity values (symbols 11 [] and 14 []) were verbs, but the remainder of the verb category shows lower iconicity values than the nouns. Verbs however, were chosen more often in total (see Figure 9). Although not tested statistically, it seems then that nouns were the most iconic.

These subjective findings were formalised and are presented in Table 25.

Table 25: Summary of total frequency of selection and iconicity values across word classes

Grammatical category	Total frequency of selection		Frequency of correct responses (iconicity values)	
	Average (total/no of symbols in category)	*Total*	*Average (total/no of symbols in category)*	*Total*
Social (7 symbols)	97,28	681	11,57	81
Verbs (11 symbols)	116,09	1277	22,90	252
Descriptors (11 symbols)	74	814	12,36	136
Prepositions (1 symbol)	28	28	1	1
Nouns (6 symbols)	93,66	562	28,16	169

It seems that Table 25 supports the notion that although verbs were chosen most often on average, nouns were more often identified correctly, revealing that nouns were the most iconic symbols on the display. These results seem to confirm that of Mizuko (1987) and Bloomberg et al. (1990).

4.5.3 Gender

A study done by Solarsh (2001) investigated the verbal solutions that rural Zulu-speaking children between the ages of seven and twelve offer to everyday problems. Six scales were used to measure separate components of thinking skills. A significant gender difference was detected for four of the six scales. Although the focus of the present study differs from that of Solarsh (2001), the target populations overlap. Therefore the data of the present study were submitted to a chi square variance test ($p \leq 0.05$) to compare the amount of correct responses by boys and girls for every symbol. A significant difference was revealed for Symbol 11 [] only. The results are summarised in Table 26.

Table 26: Gender differences

Gender	Amount of participants	Correct responses	p
Female	52	50	
Male	42	31	
			0,0018

It seems that gender did not influence performance on this task. These results agree with the findings of Duncan et al. (1973). They investigated several aspects of pictorial perception across different cultural groups and different levels of urbanisation. The Rural Zulu group performed poorly on all measures. The researchers found gender differences in the performance of the Rural Tsonga, Urban Tsonga and Urban Zulu groups, but not for the Rural Zulu group. They hypothesised that in both Tsonga groups and the Urban Zulu group boys performed better than girls since it was more common for boys to attend school than for girls. Very few children from the Rural Zulu group attended school, so that both genders were minimally exposed to Western pictorial conventions and both genders performed poorly. The present study was performed in an area approximately 100 km from the area of the Duncan et al. (1973) study, but thirty years later. Today children from both genders do commonly attend school so that they generally have equal opportunities for exposure to pictures and symbols. This might explain the absence of gender differences in the present study.

4.6 Summary

In this chapter the findings of the study are presented and discussed. The results reveal that the 36 PCS symbols concerned are between 2,8% and 22,2% iconic for the participants involved. It is proposed that the unique nature of the task resulted in symbols influencing each other, and therefore error responses were discussed alongside correct responses. Symbols are described according to iconicity as well as distinctiveness and possible reasons for the classification of each symbol are discussed. It has been determined that factors including the total frequency of selection of symbols, the position of symbols on the communication overlay and the gender of participants did not influence performance on the task. It is noted that symbols classified as nouns were as a group the most iconic.

CHAPTER FIVE

SUMMARY AND CONCLUSIONS

5.1 Introduction

This chapter provides a short summary of the results of this study as well as a discussion of the implications for practice. The study is critically evaluated in terms of limitations and strengths, and finally recommendations for further research are made.

5.2 Summary of the results

The purpose of this study was to determine how accurately typically developing rural Zulu-speaking children could identify 36 PCS symbols, to describe error patterns and to investigate possible influences on results. Data were obtained by means of a test task where participants had to select a symbol from a commercially available communication overlay in response to a spoken label.

The results of the present study indicated that the 36 PCS symbols that were presented were generally low in iconicity for rural Zulu speakers between 10 and 11 years. The average iconicity of the 36 symbols was 2,8% or 11,1% or 22,2%, depending on the criterion used. In the light of the argument by Lloyd et al. (1985) that the criterion suggested by Hoemann (1975) (iconicity values ≥ 25%) was too lenient, it is suggested that only the criteria suggested by Doherty et al. (1985) be used. Accordingly, it seems reasonable to say that the symbols on the overlay were between 3% and 11% iconic on average.

Error analysis showed that symbols could be described along the iconicity continuum at the same time as being described as distinctive or indistinctive. "Distinctiveness" is a term that was coined for use in this study and describes whether a symbol evokes precise meaning or multiple/no meanings in the mind of a viewer. The influence of distinctiveness on learnability is unknown, but it is hypothesised that high distinctiveness would aid learning of symbols.

It seemed that some symbols scored low on iconicity and/or distinctiveness due to the nature of the task. Presentation of an array of symbols related to the same theme possibly resulted in overlap between the conceptual features of some of them. Previous iconicity studies presented a smaller selection of symbols and the symbols were generally unrelated to each other. It can be reasoned that such a task would be easier than the one employed in this study, possibly resulting in better iconicity scores.

Apparently participants did not make maximum use of the information afforded them by arrows in symbols. Either participants did not interpret arrows as indicating movement, or they did not utilise information about *direction* of movement. A finding by Moolman and Alant (1997) correlates with this observation. They taught selected Blissymbols to six mildly cognitively impaired children according to global and analytical teaching methods. Retesting a month after the training revealed that participants from the analytical group could use many of the elements, but paid no attention to the indicators. They suggested that the opaque nature of indicators could serve as explanation for this. Duncan et al. (1973) found that cultural differences were most prominent when pictures contained cues to imply motion. They argue that most Western pictorial conventions like indicating depth and the use of shadows are realistic, meaning that the drawing looks like what the real object would have looked like from that angle. Since action is really a series of pictures, it is unnatural to depict it in one picture, necessitating the use of 'unrealistic' and arbitrarily chosen cues such as vibration marks and arrows. Likewise Luftig and Bersani (1985) found that there was no significant difference between translucency values for verbs and objects in Bliss, while in ASL verbs were significantly more translucent than objects. They blame the action indicator employed in Blissymbols for this. The lack of experience with pictures including such conventional cues, added to the opaqueness of the arrows may explain why participants did not use the information offered by them (Miller, 1973).

The total frequency of selection of symbols did not influence the frequency of correct responses (iconicity values) of symbols, neither did the position of the symbols on the communication overlay. It was found that as a whole the noun category was the most iconic grammatical category. Gender did not play a significant role in the outcome of this task.

5.3 Clinical implications

5.3.1 The use of PCS

The iconicity of the selected PCS symbols was generally low for the population studied. This finding serves as a reminder that although PCS had been described as one of the most iconic symbol sets (Mirenda & Locke, 1989; Mizuko, 1987), the meanings of these symbols are still not entirely guessable. A factor that could have contributed to low iconicity in this population was the presence of arrows in many of the symbols. It might prove profitable to use a symbol set/system that employs more postural cues and fewer arrows. Alternatively, clinicians must be aware that special training in the use of arrows might be needed (Moolman & Alant, 1997).

5.3.2 The use of commercially available communication overlays

The results yielded by this study indicate that the unmodified use of commercially available communication overlays containing PCS symbols may not be ideal in the South African context. Many of the themes of the overlays and the concepts depicted on them do not promote experiential equivalence with Southern African cultures. The fact that the researcher and judges had difficulty in finding an overlay that contained no concepts that would obviously be foreign to rural Zulu speakers serves as a case in point. It is suggested that clinicians choose themes that are relevant to their clients, and then compile communication overlays relating to those themes and the experiential background of the client.

Considerable difficulty was experienced in translating the labels of the 36 symbols. In an attempt to design messages that were generic and also not authoritarian, the source phrases were short and non-specific. These sentences did not contain enough information to make accurate translation possible, confirming that the shorter a sentence, the more difficult it is to translate (Retief, 1988). It is proposed that clinicians consider using word-based PCS symbols rather than sentence-based PCS symbols if material is to be translated. Alternatively, modification of the source phrases as described in 3.4.2.2 (see also Appendix G) could be considered.

5.3.3 Methodological concerns in the testing of iconicity

It has been mentioned that the presentation of an array of symbols all related to the same theme, may have had an influence on iconicity and distinctiveness values (see 2.8). Yet symbols are most often used in such a context. It is therefore argued that whatever influence these factors had on the values obtained, served to make the values more functional and socially valid. It is suggested that this form of presentation be considered in future iconicity studies.

5.4 Critical evaluation of the study

This study constitutes the first step towards obtaining culture-specific iconicity information in South Africa. It seems that the translation process employed yielded a reliable translation (see Appendix C), thereby strengthening the validity of the results. The novel method of presentation (in the context of a communication overlay) is regarded as an advantage because it yielded functional and socially valid results.

The relatively small sample is seen as a limitation of the study.

5.5 Recommendations for future research

Recommendations for future research are:

- The iconicity of PCS for South African cultures needs to be further investigated. The present study can be replicated on Zulu-speaking persons from other parts of the country or from urban areas in order to obtain a more representative body of data. Future iconicity studies should also focus on other cultures indigenous to South Africa.
- The construct of "distinctiveness" should be validated in future research. Consequently the influence of distinctiveness on the learnability of symbols should be investigated. It has been suggested that there may be a positive correlation between these two variables.
- Iconicity should be investigated in the context in which it will be used, for example a communication overlay. This will not replace other methodologies, but yield additional information about iconicity.
- It would be interesting to investigate the influence of such a methodology on iconicity values obtained. For example, two communication overlays containing several overlapping symbols, could be presented to the same sample of participants on different occasions. A comparison of the iconicity values for those symbols that appeared on both communication overlays may prove to be valuable.
- Alternative methods for obtaining culture-specific iconicity information in the context of a communication overlay should be explored. One option would be to present an overlay and ask participants to produce a label for each symbol. Another suggestion is to present participants with a matrix-36 communication overlay without symbols, read the labels one by one and request participants to draw a 'picture' for each label in the squares provided.
- Children's perceptions of indicators like arrows need to be further explored. Performance on tasks containing indicators across culture groups should be compared. The influence of schooling and urban or rural living on the interpretation of indicators, should be further investigated.

5.6 Summary

In this chapter the conclusions of the research are presented and the clinical implications of these conclusions are discussed. A critical evaluation of the study is followed by recommendations for further research.

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Appendix A: Communication overlay as used in the study

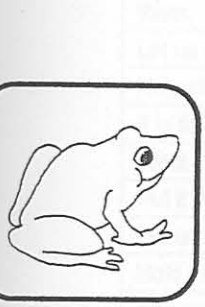
Numbers were randomly assigned as follows:

33	9	24	28	21	26
29	17	4	13	25	27
3	35	8	22	2	12
15	14	6	1	30	16
31	20	7	10	36	18
5	19	11	23	34	32

Appendix B: Training overlay as used in study

picture	**ball**	**the crowd**	**brush**	**protect**	picture
cloud	picture	**ugly**	**in the kraal**	picture	**grandmother**
goat	**mothers**	**teacher**	picture	**morning**	**green**
play	picture	**woke**	**pretty**	**loosen**	**cake**
home	**see**	**want**	picture	**cow**	picture
sinned	**in the nest**	picture	**come**	picture	**food**

The words were taken randomly from a grade one reader.



ibhola

besixuku

xubha

vikela

amafu

elibi

esibayeni

ukhulu

imbuzi

omama

uthisha

ekuseni

oluhlaza

dlala

vukile

omuhle

xegisa

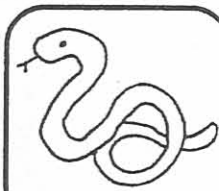
ikhekhe

ekhaya

bona

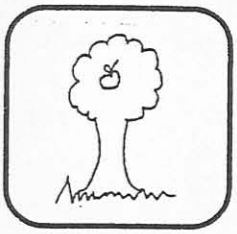
ufuna

inkomo



sonile

esidlekeni



woza

ukudla

Appendix C: First, Second and Final Consensus

English phrase	First Consensus	Second Consensus	Final Consensus
What a mess!	Kwaze kwangcola!	Kwaze kwangcola!	Kwaze kwangcola!
It looks like a bomb went off!	Sengathi kuqhume ibhomu!	Sengathi kuqhume ibhomu!	Sengathi kuqhume ibhomu!
It is dirty.	Kungcolile.	Kungcolile.	Kungcolile.
You need to change them.	Udinga ukuwashintsha.	Udinga ukuwashintsha.	Udinga ukuwashintsha.
Let us take it off.	Asikususe.	Asikususe.	Asikususe.
Help me, please.	Ngicela ungisize.	Ngicela ungisize.	Ngicela ungisize.
It is finished.	Kuphelile.	Kuphelile.	Kuphelile.
What is next?	Kulandelani?	Kulandelani?	Kulandelani?
Put it in the tub.	Faka kubhavu.	Faka kubhavu.	Faka kubhavu.
Let us make the bed.	Asendlale umbhede.	Asendlale umbhede.	Asendlale umbhede.
Hold this, please.	Ngicela ubambe lokhu.	Ngicela ubambe lokhu.	Ngicela ubambe lokhu.
You need to pull.	Udinga ukudonsa.	Udinga ukudonsa.	Udinga ukudonsa.
It is crooked.	Kugwegwile.	Kugwegwile.	Kugwegwile.
Let us do it again.	Asiphinde futhi.	Asiphinde futhi.	Asiphinde futhi.
Fold it back.	Kugoqele emuva.	Kugoqele emuva.	Kugoqele emuva.
Tuck it in.	Kushutheke.	Kushutheke.	Kushutheke.
Let us put on...	Maseleke...	Masendlale...	Maseleke...
...the sheets	...amashidi.	...amashidi.	...amashidi.
...the blanket	...ingubo.	...ingubo.	...ingubo.
...the pillowcase	...iphilo.	...iphilo.	...iphilo.
Thank you.	Ngiyabonga.	Ngiyabonga.	Ngiyabonga.
You are welcome.	Wamukelekile.	Wamukelekile.	Wamukelekile.
Let me...	Ake ngi...	Ake ngi...	Ake ngi...
Where is it?	Kuphi?	Kuphi?	Kuphi?
Put it here.	Beka lapha.	Beka lapha.	Beka lapha.
Puff it up.	Uvokomalise.	Khukhumalisa.	Khukhumalisa.
It is nice and soft.	Kuntofontofo.	Kuntofontofo.	Kuntofontofo.
What do you think?	Ubona kanjani?	Ubona kanjani?	Ubona kanjani?
It looks good.	Kubukeka kahle.	Kubukeka kahle.	Kubukeka kahle.
It looks bad.	Kubukeka kabi.	Kubukeka kabi.	Kubukeka kabi.
Whoops!	Hhayi bo!	We!	We!
Look at this.	Buka lokhu.	Buka lokhu.	Buka lokhu.
We forgot.	Sikhohliwe.	Sikhohliwe.	Sikhohliwe.
Yes.	Yebo.	Yebo.	Yebo.
No.	Cha.	Cha.	Cha.
It is nice and clean.	Kuhlanzeke kahle.	Kuhlanzeke kahle.	Kuhlanzeke kahle.

Appendix D: Test protocol

Test protocol in isiZulu

Basic instructions for training:

(research assistant augmented where necessary)

Sizodlala umdlalo ngamagama nangezithombe. Nansi-ke incwadi yalowo nalowo, kanye nepeni. Akesibheke ikhasi lokuqala. Ngizobala kawu-30 ngenkathi nibukisisa kahle amagama kanye nezithombe ezikuleli khasi, bukisisani kahle (time passes).

Siphelile isikhathi! Ibani nivula amapeni izivalo nizifake ngemuva, zishiyeni kanjalo izivalo nize niqede.

Lalela-ke: ngizosho igama elilodwa ngesikhathi. Cinga igama noma isithombe qede udwebe isiphambano egameni elihmbisana nalokho engikushoyo. Fihla umsebenzi wakho ukuze umakhelwani wakho engakopeli. Uzobhekisisa kahle esikweleni lelo gama noma isithome. Bekani uMiss Haupt. Kanje:

1. Elibi

Vula ikhasi elilandelayo

Umangithi 'OK', bhalani masinya ngoba sengizodlulela phambili. Yenzo isiphambano esisodwa ekhasisni.

2. Ukudla

OK, vula ikhasi elilandelayo

3. Umlilo

OK, vula ikhasi elilandelayo

Zama-ke manje nawe:

4. Sonile

OK, vula ikhasi elilandelayo

5. Isikele

OK, vula ikhasi elilandelayo

6. Isandla

OK, vula ikhasi elilandelayo

Precise instructions for test:

(research assistant read instructions strictly according to protocol)

Manje asibheke iphepha lesibili, kodwa-ke lona linezithombe zodwa. Ngizobala kawu-30 lapho wena ubukisisa kahle izithombe. Ningenzi lutho ngizonishela uma sekudinga nibhale (time passes).

Siphelile-ke isikhathi. Kulokhu-ke kunzinyana kunokokuqala, kanti futhi uzozenzela wedwa ngaphandle kosizo. Ngakho bukisisa kahle usiqonde futhi sihambisane nengizokusho. Buka isithombe ngasinye ngasinye ngaphambi kokukhetha. Fihla umsebenzi wakho ukuze umakhelwani wakho engakopeli. Sengizosho amagama-ke. Wena thola isithombe esihambisana negama engilishoyo bese udweba isiphambano ngepeni lakho ungubukeli komunye. Bheka kahle zonke izithombe ungakakhethi:

1. Kulandelani?

OK, phenya ikhasi

2. Kuntofontofo.

OK, phenya ikhasi

3. Cha.

OK, phenya ikhasi – page 4

4. Udinga ukuwashintsha.
OK, phenya ikhasi

5. We!
OK, phenya ikhasi

6. Sikhohliwe.
OK, phenya ikhasi

7. Ubona kanjani?
OK, phenya ikhasi – page 8

8. Kuhlanzeke kahle.
OK, phenya ikhasi

9. Asikususe.
OK, phenya ikhasi

10. Kugwegwile.
OK, phenya ikhasi

11. Udinga ukudonsa.
OK, phenya ikhasi – page 12

12. Faka kubhavu.
OK, phenya ikhasi

13. Kuphelile.
OK, phenya ikhasi

14. Asendlale umbhede.
OK, phenya ikhasi

15. Ngiyabonga.
OK, phenya ikhasi – page 16

16. …ingubo.
OK, phenya ikhasi

17. Maseleke...
OK, phenya ikhasi

18. …amashidi.
OK, phenya ikhasi

19. Kuphi?
OK, phenya ikhasi – page 20

20. Buka lokhu.
OK, phenya ikhasi

21. Kushutheke.
OK, phenya ikhasi

22. Kungcolile.
OK, phenya ikhasi

23. Kugoqele emumva.
OK, phenya ikhasi – page 24

24. Ngicela ungisize.
OK, phenya ikhasi

25. Khukhumalisa.
OK, phenya ikhasi

26. Kwaze kwangcola!
OK, phenya ikhasi

27. Sengathi kuqhume ibhomu!
OK, phenya ikhasi – page 28

28. Asiphinde futhi.

OK, phenya ikhasi

29. Yebo.

OK, phenya ikhasi

30. Beka lapha.

OK, phenya ikhasi

31. Wamukelekile.

OK, phenya ikhasi – page 32

32. …iphilo.

OK, phenya ikhasi

33. Ake ngi….

OK, phenya ikhasi

34. Kubukeka kabi.

OK, phenya ikhasi

35. Ngicela ubambe lokhu.

OK, phenya ikhasi – page ukugcina

36. Kubukeka kahle.

Ngibonga kakhulu! Bekumnandi. Nansi inkanyezi yakho. Unayo imibuzo? Uthisha wakho uzokuchazela ukuthi lezi zithombe zisetshenziselwani. Usuku oluhle

Prompts for use during test when necessary:

(Research assistant and researcher used these reminders in between test items when they saw fit. No more than one reminder was allowed between any two test items.)

1. Nenza kahle qhubekani.
2. Ningakopeli.
3. Khetha isithombe obona kuyisona esihambisana nengikushoyo.
4. Buka zonke izithombe kuqala unakhakhethi.
5. Ungasikhetha isithombe kabili uma ucabanga ukhuthi sihambisana nengikushoyo.

Test protocol in English

Basic instructions for training:

(research assistant augmented where necessary)

We are going to play a game with words and pictures. Here is a book and a pen for each one. Let us look at the first page. I will count to 30 while you look carefully at the words and pictures on this page. Look carefully! (time passes).

Time is up! Take the cap off your pen, put it at the back of your pen and leave it there until we have finished. Now listen: I am going to read one word at a time. Look on the paper for the word or picture that goes the best with the word I say, and draw a cross over it. Hide your work so that your neighbour cannot copy. Look carefully at every square. Look at Miss Haupt, like this:

1. ugly

Turn to the next page

When I say 'OK', you must quickly make a cross because time is running out.

2. food

OK, turn to the next page

3. fire

OK, turn to the next page

Now you try alone:

4. sinned

OK, turn to the next page

5. scissors

OK, turn to the next page

6. hand

OK, turn to the next page

Precise instructions for test:

(research assistant read instructions strictly according to protocol)

Let us now look at this page. It has pictures only. I am going to count up to 30 while you look carefully at all the pictures. Do not write anything until I tell you to. (time passes).

Time is up! This is a bit more difficult than the previous pages and you are going to work on your own. Therefore look very carefully before you choose the picture that goes the best with what I say. Look at each picture one by one before you choose. Hide your work so that your neighbour cannot copy. I will again say some words. You must find a picture that goes with the word I said, and draw a cross over it with your pen. Do not look at anyone else's work. Look at all the pictures carefully before you choose:

1. What is next?

OK, turn the page

2. It is nice and soft.

OK, turn the page

3. No.

OK, turn the page – page 4

4. You need to change them.

OK, turn the page

5. Whoops!
OK, turn the page

6. We forgot.
OK, turn the page

7. What do you think?
OK, turn the page – page 8

8. It is nice and clean.
OK, turn the page

9. Let us take it off.
OK, turn the page

10. It is crooked.
OK, turn the page

11. You need to pull.
OK, turn the page – page 12

12. Put it in the tub.
OK, turn the page

13. It is finished.
OK, turn the page

14. Let us make the bed.
OK, turn the page

15. Thank you.
OK, turn the page – page 16

16. …blanket.
OK, turn the page

17. Let us put on...
OK, turn the page

18. …the sheets.
OK, turn the page

19. Where is it?
OK, turn the page – page 20

20. Look at this.
OK, turn the page

21. Tuck it in.
OK, turn the page

22. It is dirty.
OK, turn the page

23. Fold it back.
OK, turn the page – page 24

24. Help me, please.
OK, turn the page

25. Puff it up.
OK, turn the page

26. What a mess!
OK, turn the page

27. It looks like a bomb went off!
OK, turn the page – page 28

28. Let us do it again.
OK, turn the page

29. Yes.

OK, turn the page

30. Put it here.

OK, turn the page

31. You are welcome.

OK, turn the page – page 32

32. …pillow case.

OK, turn the page

33. Let me….

OK, turn the page

34. It looks bad.

OK, turn the page

35. Hold this, please.

OK, turn the page - last page

37. It looks good.

Thank you very much! It was enjoyable. Here is a star for you. Does anyone have any questions? Your teacher will tell you how these pictures are used. Have a nice day.

Reminders for use during test when necessary:

(Research assistant and researcher used these reminders in between test items when they saw fit. No more than one reminder was allowed between any two test items.)

1. You are doing well, keep it up.
2. Don't copy from your neighbour.
3. Choose the picture that goes with what I'm saying.
4. Look at all the pictures before you choose.
5. You can choose a picture twice if you think it goes with what I say.

Appendix E: Checklist for determining consistency across sessions

Name of the school:

Session number:

- Manje asibheke iphepha lesibili, kodwa-ke lona linezithombe zodwa.
- Ngizobala kawu-30 lapho wena ubukisisa kahle izithombe.
- Ningenzi lutho ngizonishela uma sekudinga nibhale.
- Siphelile-ke isikhathi. Kulokhu-ke kunzinyana kunokokuqala, kanti futhi uzozenzela wedwa ngaphandle kosizo.
- Ngakho bukisisa kahle usiqonde futhi sihambisane nengizokusho.
- Buka isithombe ngasinye ngasinye ngaphambi kokukhetha.
- Fihla umsebenzi wakho ukuze umakhelwani wakho engakopeli.
- Sengizosho amagama-ke.
- Wena thola isithombe esihambisana negama engilishoyo bese udweba isiphambano ngepeni lakho ungubukeli komunye.
- Bheka kahle zonke izithombe ungakakhethi

Appendix F: First translations

Nr	First translation by TR	First translation by WM	First translation by FC
1.	Kungcole kangaka!	Nansi inkanankana!	Hawu lobu hliphihliphi!
2.	Umshini!	Sengathi kuqhuma ibhomu!	Kubukeka njengebhomu liqhuma!
3.	Zingcolile.	Bangcolile.	Zingcolile.
4.	Udinga ukuzishintsha.	Thatha okunye.	Kufanele sibashintshe.
5.	Asikhumule lokhu.	Masikususe.	Asisuse lokhu.
6.	Ngicela ungisize.	Ngicela ungisize.	Ngicela ungisize.
7.	Kuphelile.	Ngiqedile.	Kuphelile.
8.	Kulandelani?	Yini elandelayo?	Ikuphi okulandelayo?
9.	Faka kubhavu.	Kufake kubhasikidi.	Faka kubhasikidi.
10.	Asindlule umbhede	Masendlule umbhede.	Asindlale umbhede.
11.	Awubambe lapha.	Ngicela ubambe lokhu.	Ngicela ubambe lapha.
12.	Udinga ukudonsa.	Kumelwe ukudonse	Kufanele udonse.
13.	Kuqobile.	Kugwegwile.	Kugwegwile.
14.	Asiphinde futhi.	Masiphinde sikwenze.	Asiphinde senze futhi.
15.	Kugoqe / kusonge futhi.	Kugoqe kuye emuva.	Kufanele ukugoqele ngemuva.
16.	Kushutheke.	Kumelwe ukushutheke.	Kufanele ushutheke phakathi.
17.	Asigqoke.../ Asimbathe.../ Asifake...	Masikubeke ngaphezulu...	Asibeke phezulu...
18.	...amashidi.	...kwamashidi.	...amashidi.
19.	...izingubo	...kwengubo.	...ingubo.
20.	...iphilo.	...kwesiqamelo	...isikhwama somcamelo.
21.	Ngiyabonga.	Ngiyabonga.	Ngiyabonga.
22.	Wemukelekile.	Wamukelekile.	Umukelekile.
23.	Ngivumele	No translation	Ake ngi...
24.	Ikuphi?	Kuphi?	Ikuphi?
25.	Yibeke lapha.	Kubeke lapha.	Beka lapha.
26.	Yikhuluphalise.	Kumelwe ukunonise.	Kufanele ikhuluphaliswe.
27.	Ithambe kamnandi	Kuthambe kahle.	Imnandi futhi ithambile.
28.	Ucabangani?	Ubona kanjani?	Ucabangani?
29.	Ibukeka kahle.	Kubukeka kahle.	Kubukeka kahle.
30.	Ibukeka kabi.	Kubukeka kabi.	Kubukeka kabi.
31.	Ncinci	Nakhuya!	Hawu!
32.	Buka nje.	Buka lokhu.	Buka lokhu.
33.	Sikhohliwe / Silibele.	Sikhohliwe.	Sikhohliwe.
34.	Yebo	Yebo.	Yebo.
35.	Cha	Cha.	Cha.
36.	Kuhlanzeke kahle.	Kuhlanzeke kahle.	Kuhle futhi kuhlanzekile.

Appendix G: Original and modified source phrases

Original source phrase	Modified source phrase
What a mess!	What a mess!
Looks like a bomb went off!	It looks like a bomb went off!
They're dirty.	It is dirty.
Need to change them.	You need to change them.
Let's take this off.	Let us take it off.
Help me, please.	Help me, please.
Finished.	It is finished.
What's next?	What is next?
Put it in the hamper.	Put it in the tub.
Let's get the bed made.	Let us make the bed.
Hold this, please.	Hold this, please.
Need to pull it.	You need to pull.
It's crooked.	It is crooked.
Let's do it again.	Let us do it again.
Have to fold it back.	Fold it back.
Got to tuck it in.	Tuck it in.
Let's put on...	Let us put on...
...the sheets	...the sheets
...the blanket	...the blanket
...the pillow case	...the pillow case
Thank you.	Thank you.
You're welcome.	You are welcome.
Let me.	Let me...
Where is it?	Where is it?
Put it here.	Put it here.
Have to make it fat.	Puff it up.
Nice and soft.	It is nice and soft.
What do you think?	What do you think?
Looks good.	It looks good.
Looks bad.	It looks bad.
Whoops!	Whoops!
Look at this.	Look at this.
We forgot.	We forgot.
Yes.	Yes.
No.	No.
Nice and clean.	It is nice and clean.

Appendix H: First back translations

* indicates where translator reported use of a dictionary.
Bold type marks problem phrases

Source	Translator 4	Translator 5	Translator 6
What a mess!	How dirty it has become!	My, it's dirty!	How dirty it has become!
It looks like a bomb went off!	It's as if a bomb has exploded!	It is as if a bom has exploded!	It is as if a bom has exploded!
It is dirty.	It is dirty / filthy.	It's dirty.	It is dirty.
You need to change them.	You need to change them.	You need to change them	You need to change them
Let us take it off.	Let us / you remove it.	Let us remove it	Let us remove it.
Help me, please.	Please help me.	Please help me?	Could you please help me?
It is finished.	It is finished / completed	It's finished.	It is finished
What is next?	What follows?	What follows / what comes next?	What is next?
Put it in the tub.	Put it in the bath.	Put it in the bath.	Put it in the bath.
Let us make the bed.	Let us make the bed.	Let's make the bed.	Let us make the bed.
Hold this, please.	Please hold this.	Please hold this.	Could you please hold this?
You need to pull.	You need to pull.	You need to pull.	You need to pull.
It is crooked.	It is crooked	It's crooked	It is crooked.
Let us do it again.	Let us repeat again	Let's do it again Let's try again.	Let us repeat it.
Fold it back.	**Fold it back.**	**Fold it behind.**	**Fold it up at the back. / put it on top.**
Tuck it in.	Put it inside / under.	Put it underneath / away.	Put it inside.
Let us put on...	**?**	**?**	***Let us cover it**
...the sheets	...sheets	...sheets	...sheets
...the blanket	...blanket	...blanket / dress	...blanket / clothing
...the pillowcase	...pillow	...pillow	...pillow
Thank you.	Thank you..	Thank you.	Thank you
You are welcome.	You are accepted.	You are welcome	You are welcome.
Let me...	Let me	Let me.	Let me..
Where is it?	Where?	Where is it?	Where?
Put it here.	Put it here	Look here.	Put it here
Puff it up.	**?**	**?**	***Puff it up.**
It is nice and soft.	**It is soft.**	**It is comfortable**	**It is comfortable / soft**
What do you think?	How do you see it? / What is your opinion?	How do you see it?	How do you see it?
It looks good.	It looks good.	It looks good.	It looks good.
It looks bad.	It looks bad.	It looks bad / terrible	It looks bad.
Whoops!	**No! / uh oh!**	**Oh no! (not only in negative sense).**	**Exclammation of disapproval**
Look at this.	Look at this	Look at this.	Look at this.
We forgot.	We have forgotten.	We forgot.	We forgot.
Yes.	Yes.	Yes.	Yes.
No.	No.	No.	No.
It is nice and clean.	Clean it well.	It's nice and clean.	It is nicely clean

Appendix I: Second back translations

Source	Translator 7	Translator 8
What a mess!	What a mess!	It is now dirty!
It looks like a bomb went off!	It looks like a bomb has exploded!	It seems like a bomb explosion.
It is dirty.	It is dirty.	It is dirty.
You need to change them.	You need to change them.	You need to change them.
Let us take it off.	Let us remove it.	Let us take it away.
Help me, please.	Please help me.	Please help me.
It is finished.	It is finished.	It is finished.
What is next?	What is next?	What is next?
Put it in the tub.	Put in the tub.	Put it in the bath.
Let us make the bed.	Let us make the bed.	Let us make the bed.
Hold this, please.	Please hold this.	Please hold this.
You need to pull.	You need to pull.	You need to pull.
It is crooked.	It is skew / cooked.	It is crooked.
Let us do it again.	Let us repeat again.	Let us repeat it.
Fold it back.	Roll it backwards.	Fold it toward the back.
Tuck it in.	Push it in.	Put it in.
Let us put on...	Let us pile... / Let us cover (smth) with...	Let us put...
...the sheets	...the sheets	...the sheets
...the blanket	...a blanket / rug	...blanket
...the pillowcase	...the pillowcase	...pillowcase
Thank you.	Thank you.	Thanks.
You are welcome.	You are welcome.	You are welcome.
Let me...	Let me...	Let me...
Where is it?	Where?	Where?
Put it here.	Put it here.	Put it here.
Puff it up.	Rise.	Make it rise up.
It is nice and soft.	It is soft.	It is soft.
What do you think?	What do you say? / What is your opinion?	How do you see it?
It looks good.	It looks nice / wonderful.	It looks good.
It looks bad.	It looks bad / disgusting.	It looks bad.
Whoops!	(of contempt / surprise / denial)	Wow!
Look at this.	Look at this.	Look at this.
We forgot.	We forgot.	We have forgotten.
Yes.	Yes.	Yes.
No.	No.	No.
It is nice and clean.	It is scrupulously clean.	It is well cleaned.

Appendix J: Letter to Kwazulu-Natal Department of Education and Culture

Mr V. J. Dumakude
SEM: Kranskop East Circuit
The Lodge
116 Loop Street
Pietermaritzburg
3201
19 May 2001

Mr. Dumakude

Research into the iconicity of symbols

I am a part-time student at the University of Pretoria and I am busy with my Masters studies in the field of Alternative and Augmentative Communication. This is a branch of speech therapy where people who are severely disabled and cannot learn to speak or take long to do so, are provided with alternative means of communication. One strategy would be to make a communication board containing picture-like symbols to represent ideas. The individual then points to these pictures to indicate what he or she wants to communicate.

The iconicity of a symbol is the degree to which the symbol visually represents its referent. If a symbol is highly iconic, it is easy for individuals to learn to use it. Most of the symbol sets currently in use in South Africa were developed in the United States of America. This is a dilemma since iconicity is culture bound: people from different cultures will view the same symbol differently. We therefore cannot simply use the American symbols without taking into account the many different cultures in our country.

I am planning to investigate the iconicity of a certain set of symbols, the Picture Communication Symbols, for Zulu speaking children aged ten.

Herewith I ask permission to conduct the research in certain primary schools in the Kranskop area. All information gathered in the process will be seen as confidential, and the results of the study would be available to you if you so wish.

Thank you for your time

Lize Haupt

Appendix K: Letter to judges

Dear

Thank you very much for being prepared to help me with my study. I want to assure you from the outset that all information gathered by me will be treated confidentially and that you will not be identified in any publication.

I am studying the iconicity of certain communication symbols for rural Zulu children. Iconicity is the degree to which a symbol visually represents its referent. I am planning to show 36 line drawings on a communication overlay to each child, say the labels for the pictures in isiZulu and have the child point to the drawing he / she thinks represents each phrase the best.

I would like to make sure that all the drawings on the communication overlay represent concepts that will not be foreign to a rural Zulu child. Therefore I need you to examine communication overlays to tell me which of the 36 concepts or ideas on each overlay might be foreign to such a child. The children who will be tested all live in the area of Kranskop. So please try to judge the overlays with ten-year-olds from the Kranskop area in mind.

I have included five sets of phrases and a questionnaire with this letter. Please fill in the questionnaire before you start. Then look at the 36 concepts contained in each set individually, and decide whether you think a rural Zulu child, aged ten, will know it. Please mark all the concepts that you think will be foreign. The aim is to find one overlay that contains no foreign concepts at all.

Two other isiZulu speakers are also helping me with this. When all three of you have finished we will come together and briefly discuss your findings. In that meeting we will choose one overlay that all agree has got no foreign concepts.

Thank you very much for your willingness!

Regards

Lize Haupt

Appendix L: Letter to first translators

Dear

Thank you very much for your willingness to participate in my study. I want to assure you from the outset that all information gathered by me will be treated confidentially.

I am studying the iconicity of certain communication symbols for rural Zulu children. Iconicity is the degree to which a symbol visually represents its referent. I am planning to show 36 line drawings on a communication overlay to children, say the labels for the pictures in isiZulu and have each child point to the drawing he / she thinks represents each word the best.

I have included the 36 concepts that are represented on the communication overlay, as well as a questionnaire with this letter. Please fill in the questionnaire before you start translation. While translating the concepts please keep in mind that your audience will be ten-year-old rural isiZulu-speaking children from the Kranskop area. I will have a Zulu research assistant who will read the phrases.

A panel of three translators, including yourself, will do the first translation into isiZulu. The translators will work independently, but a meeting might be necessary to discuss discrepancies between translations should they occur. I can only accept a translation if all three translators agree on it. Please do not consult with any of the other translators, however, during the first translation.

Then all 36 concepts will be translated back into English by another panel of three translators. This is to see whether the translation into isiZulu is indeed valid. If some discrepancies occur here, both panels of translators will have to meet. Otherwise, the translation will be accepted.

Therefore once you have finished, please let me know so that I can collect the translation and compare it to that of the other translators. I will let you know as soon as possible whether a meeting will be necessary.

Thanks once again for your support!

Regards

Lize Haupt

Appendix M: Letter to second and third translators

Dear

Thank you very much for your willingness to participate in my study. I want to assure you from the outset that all information gathered by me will be treated confidentially.

I am studying the iconicity of certain communication symbols for rural Zulu children. Iconicity is the degree to which a symbol visually represents its referent. I am planning to show 36 line drawings on a communication overlay to children, say the labels for the pictures in isiZulu and have each child point to the drawing he / she thinks represents each word the best.

A panel of three translators translated the 36 phrases into isiZulu. Next, all 36 concepts need to be translated back into English by a second panel of three translators, including yourself. This is to see whether the translation into isiZulu is indeed valid. If some discrepancies occur here, both panels of translators will have to meet. Otherwise, the isiZulu translation will be accepted.

I have included the 36 isiZulu phrases, as well as a questionnaire with this letter. Please fill in the questionnaire before you start translation. Then translate all the phrases to English.

Once you have finished, please let me know so that I can collect the translation and compare it to that of the other translators. I will let you know as soon as possible whether a meeting will be necessary.

Thanks once again for your support!

Regards

Lize Haupt

Appendix N: Summary of results of phase two of Pilot Study

Question	Correct		Popular error 1		Popular error 2		Others	
	Sess 1 %	Sess 2 %	Sess 1 %	Sess 2 %	Sess 1 %	Sess 2 %	Sess 1 %	Sess 2 %
1	20	20	40	10	20	20	20	50
2	10	30	20	20	30	10	40	40
3	0	20	50	40	10	20	40	20
4	10	20	50	30	10	10	30	40
5	50	50	30	20	0	10	20	20
6	20	30	30	20	20	20	30	30
7	10	0	30	20	30	20	30	60
8	40	50	10	10	10	10	40	30
9	0	0	40	50	20	20	40	30
10	20	20	30	20	20	20	30	40
11	80	90	10	0	0	10	10	0
12	70	70	20	20	10	10	0	0
13	20	20	60	50	10	20	10	10
14	90	100	10	0	0	0	0	0
15	10	30	60	50	10	0	20	20
16	50	60	10	20	10	10	30	10
17	0	0	40	50	40	40	20	10
18	0	0	40	20	20	30	40	50
19	0	0	30	50	0	30	70	20
20	70	60	10	20	10	10	10	10
21	0	10	30	10	20	20	50	60
22	70	50	10	10	10	10	10	30
23	30	20	20	20	20	20	30	40
24	20	10	30	20	10	20	40	50
25	40	50	10	20	10	10	40	20
26	40	40	20	20	20	10	20	30
27	60	70	10	10	10	0	20	20
28	0	0	20	20	10	20	70	60
29	40	70	20	0	10	10	30	20
30	0	0	50	0	10	10	40	90
31	40	50	20	10	10	10	30	30
32	80	70	10	10	10	10	0	10
33	0	0	30	30	20	20	50	50
34	20	10	10	30	20	10	50	50
35	10	20	10	30	10	10	70	40
36	0	0	40	50	20	10	40	40

Appendix O: Information to Teachers

Dear Teacher

The children in your class viewed a collection of line drawings today. These are used as a means of communication by people who cannot use functional speech.

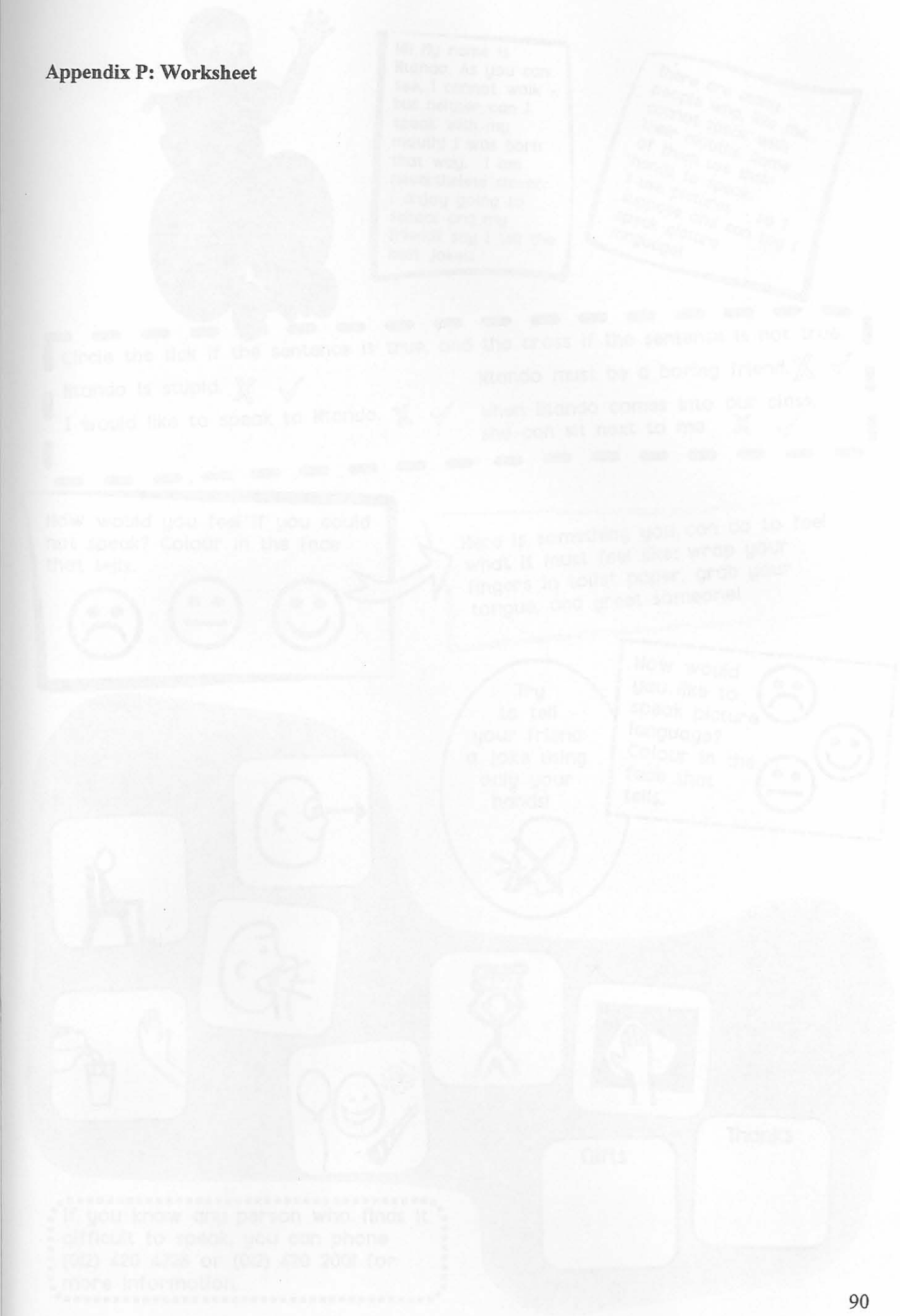
There are many people who, for various reasons, cannot speak. Some of the causes include lack of oxygen during birth, brain damage sustained in accidents, or strokes in older people. The lack of speech is not a disease or illness that you can 'catch' like the flu. It can happen to any person regardless of gender, race or social background. Therefore it is unnecessary to be scared or ashamed of people who cannot speak.

With the new policy of inclusion in South Africa it can happen that you have children with this problem in your class one day. It is very important that our children learn about disability and how to communicate with other children with disabilities. This worksheet was designed to introduce the children in your class to people with no speech.

Please explain to your children that these line drawings they saw today are only one of the options available to people who cannot speak. There are many more, like sign language and computers with voice output, where the computer 'speaks' when you press a button. All of these methods are collectively called Alternative and Augmentative Communication.

There is a centre in Pretoria where people who cannot speak are helped to find the best alternative means of communication. Please explain to your children that they can phone the numbers on the worksheet if they have family members who cannot speak or communicate in any other way.

Appendix P: Worksheet



Hi! My name is Ntando. As you can see, I cannot walk – but neither can I speak with my mouth! I was born that way. I am nevertheless clever. I enjoy going to school and my friends say I tell the best jokes!

There are many people who, like me, cannot speak with their mouths. Some of them use their hands to speak. I use pictures – so I suppose one can say I speak picture language!

Circle the tick if the sentence is true, and the cross if the sentence is not true.

Ntando is stupid. ✗ ✓

I would like to speak to Ntando. ✗ ✓

Ntando must be a boring friend. ✗ ✓

When Ntando comes into our class, she can sit next to me ✗ ✓

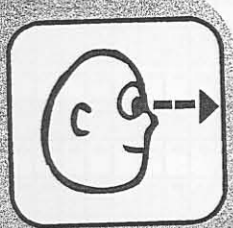
How would you feel if you could not speak? Colour in the face that tells.

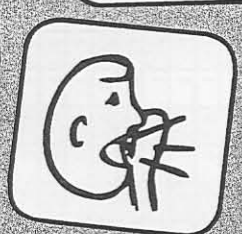
Here is something you can do to feel what it must feel like: wrap your fingers in toilet paper, grab your tongue, and greet someone!

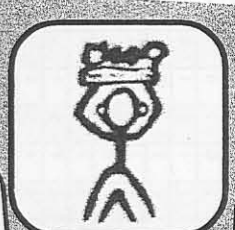
Try to tell your friend a joke using only your hands!

How would you like to speak picture language? Colour in the face that tells.

Use these pictures to speak to your friend.







Two of the squares are blank. Draw your own pictures there that will go with the words.

Gifts

Thanks

If you know any person who finds it difficult to speak, you can phone (012) 420 4728 or (012) 420 2001 for more information.

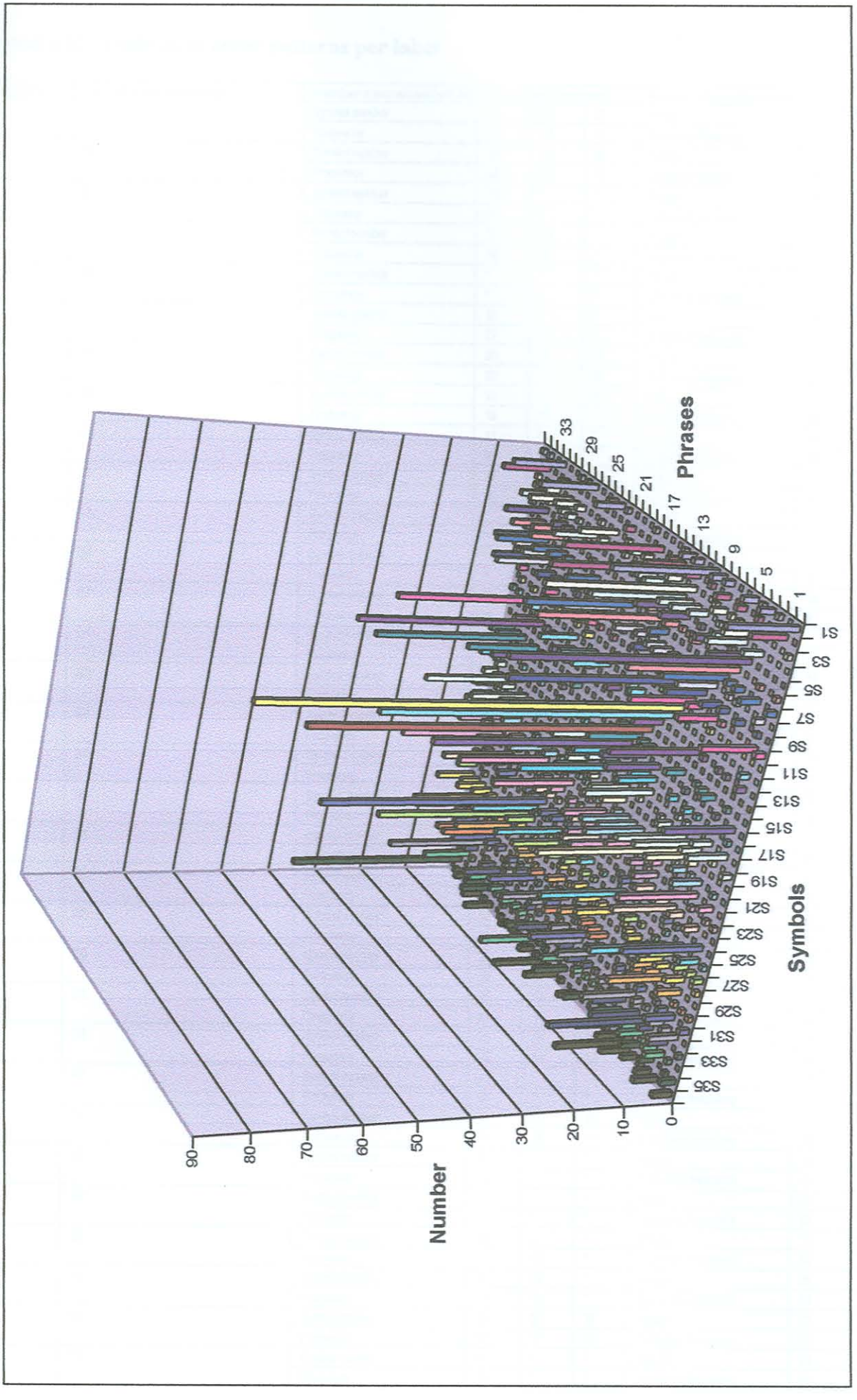
Appendix Q: Entire body of data

Symbol number

Presentation number

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
1	**14**	0	1	3	1	3	0	0	2	3	**21**	0	2	3	1	0	0	0	1	0	0	0	1	6	2	0	0	12	1	1	0	0	11	0	1	1	**1**
2	0	**7**	0	0	1	0	2	0	3	0	1	0	3	28	8	2	0	20	0	0	0	2	0	0	0	0	0	0	0	0	1	2	0	0	10	3	**2**
3	1	0	**0**	0	7	5	1	1	3	1	0	0	30	0	3	0	0	0	2	3	0	1	0	8	0	1	0	0	2	5	9	0	3	4	0	1	**3**
4	0	0	0	**4**	0	8	5	1	1	0	4	6	7	19	0	1	4	4	1	2	0	1	0	0	2	10	0	0	1	2	2	1	2	1	5	0	**4**
5	0	0	0	0	**46**	7	1	0	5	0	1	0	6	1	8	0	1	0	1	0	0	0	0	0	0	0	0	0	2	2	3	0	0	9	0	1	**5**
6	1	0	1	0	0	**22**	12	0	0	0	2	1	1	3	**27**	0	2	0	1	1	0	0	0	0	1	1	0	0	0	0	7	0	4	7	0	0	**6**
7	2	0	4	0	2	2	**13**	0	2	0	0	0	0	0	4	0	1	0	0	**22**	0	0	0	0	7	0	0	0	2	4	6	0	**11**	**10**	1	1	**7**
8	0	2	0	0	1	1	0	**8**	0	0	1	18	2	4	4	2	3	6	0	0	0	**11**	0	2	2	3	1	0	0	0	**13**	0	5	1	4	0	**8**
9	0	1	0	2	0	2	4	0	**8**	3	**36**	1	4	7	2	0	3	0	0	1	0	0	2	1	0	0	1	0	0	2	4	0	0	0	**8**	2	**9**
10	2	**11**	0	0	0	1	**8**	0	3	**13**	1	0	3	1	0	1	1	0	0	0	1	0	1	2	3	0	0	**36**	0	3	1	0	0	0	2	0	**10**
11	0	0	0	0	0	0	1	0	3	0	**81**	0	0	0	0	0	0	0	0	1	0	0	0	2	0	1	0	0	1	1	1	0	1	0	1	0	**11**
12	0	2	0	0	0	0	0	0	0	0	0	**57**	0	1	0	3	2	0	0	0	**8**	1	**8**	0	0	**8**	0	0	0	0	0	2	0	0	1	1	**12**
13	0	2	0	1	1	0	1	**18**	0	0	0	0	**6**	0	1	0	0	0	3	1	0	0	2	5	0	5	0	0	1	1	**39**	5	0	0	0	1	**13**
14	0	0	0	0	0	0	0	0	0	0	0	0	0	**67**	0	0	0	**24**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**14**
15	0	0	1	0	3	2	1	0	4	0	0	0	3	2	**11**	0	2	0	0	4	0	0	0	2	0	0	0	0	1	1	**15**	0	**32**	5	5	0	**15**
16	0	**14**	0	1	0	0	0	1	0	0	0	**11**	0	**9**	1	**40**	4	2	0	0	0	2	0	0	0	1	0	0	0	0	0	**8**	0	0	0	0	**16**
17	0	1	0	0	0	1	2	0	2	0	0	**8**	4	**25**	0	1	**10**	**16**	2	2	1	1	1	1	0	1	0	0	1	1	0	1	0	0	6	1	**17**
18	0	8	0	4	0	0	1	1	0	0	0	**14**	1	5	0	**18**	3	5	0	0	0	7	1	0	0	1	0	0	0	0	0	**21**	1	0	2	1	**18**
19	2	0	1	2	4	**12**	**14**	0	3	1	0	0	1	0	**8**	0	0	0	0	**6**	0	0	0	1	1	0	0	0	3	7	**12**	0	3	**8**	2	3	**19**
20	0	0	0	0	2	**9**	**29**	0	5	0	0	0	0	0	**5**	0	1	0	2	**5**	3	0	1	0	1	0	0	0	0	2	**13**	0	**10**	0	1	4	**20**
21	0	1	0	**6**	1	3	1	1	**10**	0	0	**12**	**8**	**10**	2	0	3	0	1	1	1	0	3	1	3	**9**	0	1	0	0	**4**	3	1	0	3	4	**21**
22	0	3	0	**16**	0	2	0	0	2	1	0	**7**	3	1	0	0	**9**	0	1	1	0	**17**	1	1	0	**19**	1	0	0	3	**3**	0	0	2	0	0	**22**
23	1	1	0	1	0	**4**	0	0	**5**	1	3	0	3	**11**	1	**9**	**4**	0	1	1	2	0	**3**	0	2	2	0	0	0	1	0	**7**	**22**	1	2	6	**23**
24	0	0	3	0	3	**13**	3	0	**4**	0	2	0	0	1	**14**	0	**8**	0	0	2	0	0	1	**2**	3	0	0	0	1	**9**	**15**	0	0	**7**	1	2	**24**
25	0	**16**	0	0	1	2	0	0	0	0	1	2	1	0	0	0	**3**	0	0	0	1	3	**4**	0	**47**	2	2	0	0	**4**	0	1	0	2	0	2	**25**
26	1	**4**	0	**19**	0	1	0	0	0	0	0	**18**	0	0	1	0	**3**	1	1	2	2	**14**	0	1	2	**14**	**4**	0	0	1	2	0	0	1	0	1	**26**
27	2	2	**3**	1	5	8	1	0	1	3	0	1	0	0	0	1	**2**	0	3	5	1	**10**	1	0	0	6	**32**	0	0	0	0	1	0	1	0	4	**27**
28	1	0	**4**	0	3	5	**4**	0	3	2	1	0	**8**	2	5	2	**3**	0	1	2	0	2	**4**	5	1	1	2	**1**	2	5	0	2	**4**	6	**4**	8	**28**
29	0	0	5	0	**12**	3	**4**	0	6	0	0	0	0	0	**8**	0	0	0	1	**4**	0	0	0	5	**4**	0	0	0	**12**	2	5	0	7	**15**	0	1	**29**
30	1	1	1	0	1	0	5	2	1	0	1	0	4	3	**3**	2	**8**	0	**4**	1	1	0	**3**	1	1	1	0	0	0	**13**	**13**	1	**3**	**3**	**13**	2	**30**
31	2	0	**6**	2	1	0	2	0	1	2	0	0	**4**	0	**13**	1	1	0	0	**3**	**3**	0	1	**10**	**3**	1	2	0	2	**3**	**9**	0	**4**	**5**	**11**	2	**31**
32	0	**6**	2	3	0	1	2	**11**	0	5	0	0	0	**8**	0	**8**	3	**4**	1	0	0	3	**8**	0	1	1	2	1	0	0	1	**21**	0	1	0	1	**32**
33	1	0	**4**	0	**3**	**20**	**10**	0	**7**	2	0	0	1	2	**4**	0	**3**	0	1	**8**	0	1	**2**	0	1	0	1	0	**8**	3	1	0	**3**	**6**	0	2	**33**
34	0	1	**4**	3	2	5	**3**	**4**	**6**	0	0	1	1	1	**2**	0	**6**	1	0	**15**	2	1	1	2	2	3	3	3	1	5	2	0	1	**10**	1	2	**34**
35	3	1	0	3	0	**4**	2	0	**9**	2	1	0	**6**	0	0	0	**7**	0	0	1	1	0	0	**4**	0	0	1	0	0	6	**4**	0	0	0	**37**	2	**35**
36	**4**	0	**5**	3	1	3	**6**	**14**	**4**	1	0	0	0	0	**4**	0	1	**7**	2	**11**	1	3	1	**2**	1	**2**	1	0	**6**	1	**4**	2	1	**2**	1	0	**36**
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	

The iconicity value for each symbol is denoted in bold.



Appendix R: Analysis of error patterns per label

Presentation number	Frequency of incorrect responses	Breakdown of incorrect responses chosen by more than ten participants				Remainder of incorrect responses	
1	77	Symbol number	11	28	33	Range	17
		Frequency	21	12	11	Collective frequency	33
2	86	Symbol number	14	18	35	Range	11
		Frequency	28	20	10	Collective frequency	28
3	91	Symbol number	13	*	*	Range	19
		Frequency	30	*	*	Collective frequency	61
4	90	Symbol number	14	26	*	Range	21
		Frequency	19	10	*	Collective frequency	61
5	48	Symbol number	*	*	*	Range	14
		Frequency	*	*	*	Collective frequency	48
6	72	Symbol number	15	7	*	Range	14
		Frequency	27	12	*	Collective frequency	33
7	81	Symbol number	20	33	34	Range	13
		Frequency	22	11	10	Collective frequency	38
8	86	Symbol number	12	31	22	Range	17
		Frequency	18	13	11	Collective frequency	44
9	86	Symbol number	11	*	*	Range	18
		Frequency	36	*	*	Collective frequency	50
10	81	Symbol number	28	2	*	Range	16
		Frequency	36	11	*	Collective frequency	34
11	13	Symbol number	*	*	*	Range	10
		Frequency	*	*	*	Collective frequency	13
12	37	Symbol number	*	*	*	Range	11
		Frequency	*	*	*	Collective frequency	37
13	87	Symbol number	31	8	*	Range	14
		Frequency	39	18	*	Collective frequency	30
14	24	Symbol number	18	*	*	Range	*
		Frequency	24	*	*	Collective frequency	*
15	83	Symbol number	33	31	*	Range	14
		Frequency	32	15	*	Collective frequency	36
16	54	Symbol number	2	12	*	Range	9
		Frequency	14	11	*	Collective frequency	29
17	84	Symbol number	14	18	*	Range	20
		Frequency	25	16	*	Collective frequency	43
18	89	Symbol number	32	16	12	Range	13
		Frequency	21	18	14	Collective frequency	36
19	94	Symbol number	7	31	6	Range	17
		Frequency	14	12	12	Collective frequency	56
20	88	Symbol number	7	31	33	Range	12
		Frequency	29	13	10	Collective frequency	36
21	93	Symbol number	12	9	14	Range	22
		Frequency	12	10	10	Collective frequency	61
22	76	Symbol number	26	4	*	Range	16
		Frequency	19	16	*	Collective frequency	41
23	91	Symbol number	33	14	*	Range	21
		Frequency	22	11	*	Collective frequency	58
24	92	Symbol number	31	15	6	Range	15
		Frequency	15	14	13	Collective frequency	50
25	47	Symbol number	2	*	*	Range	15
		Frequency	16	*	*	Collective frequency	31
26	79	Symbol number	4	12	22	Range	16
		Frequency	19	18	14	Collective frequency	28
27	62	Symbol number	22	*	*	Range	20
		Frequency	10	*	*	Collective frequency	52
28	92	Symbol number	*	*	*	Range	28
		Frequency	*	*	*	Collective frequency	92
29	82	Symbol number	34	5	*	Range	13
		Frequency	15	12	*	Collective frequency	55
30	81	Symbol number	31	35	*	Range	25
		Frequency	13	13	*	Collective frequency	55
31	85	Symbol number	15	35	24	Range	21
		Frequency	13	11	10	Collective frequency	51
32	73	Symbol number	8	*	*	Range	20
		Frequency	11	*	*	Collective frequency	62

33	91	Symbol number	6	7	*	Range	20
		Frequency	20	10	*	Collective frequency	61
34	84	Symbol number	20	*	*	Range	28
		Frequency	15	*	*	Collective frequency	69
35	57	Symbol number	*	*	*	Range	17
		Frequency	*	*	*	Collective frequency	57
36	94	Symbol number	8	20	*	Range	26
		Frequency	14	11	*	Collective frequency	69