

Table XXI: The average recognition of Group 1 and Group 2 on

CHAPTER 4

RESULTS AND DISCUSSION

4.1. INTRODUCTION

The results will be discussed according to the sub aims set out in Chapter 3. The discussion will include the following: the general performance of the two groups of subjects in Blissymbols and CyberGlyphs in terms of ease of learning and retention; the significance of the differences in performance between Bliss and Glyphs; and the performance in different word categories.

4.2. THE PERFORMANCE OF GROUPS 1 AND 2 ON BLISSYMBOLS AND CYBERGLYPHS IN TERMS OF LEARNABILITY AND RECOGNITION

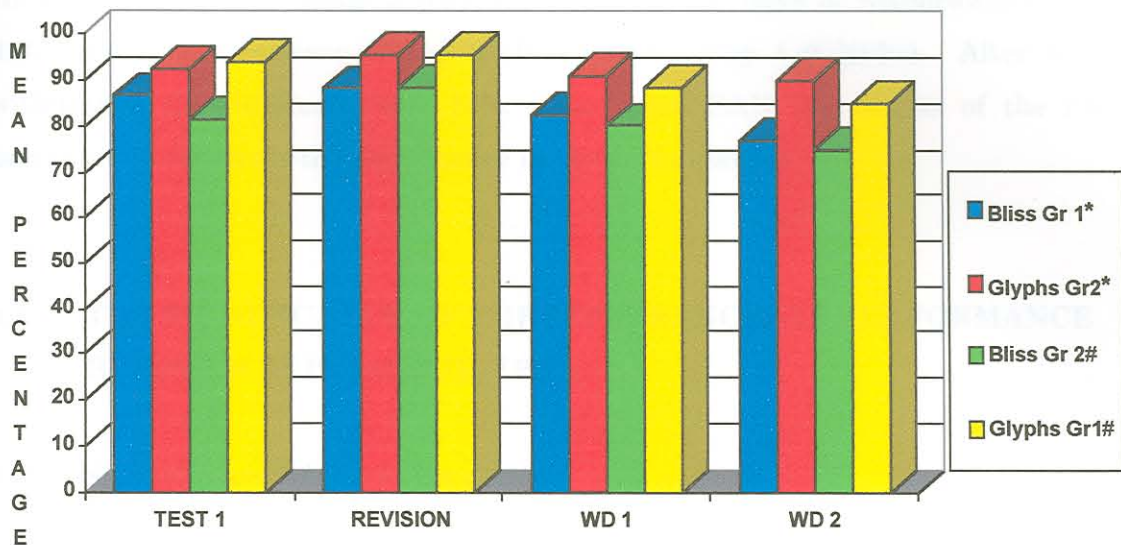
Table XXI provides a summary of the results obtained on the overall performance of Groups 1 and 2 on Blissymbols and CyberGlyphs. This table is represented graphically in Figure 3.

After the first training, the revision, withdrawal 1 and withdrawal 2. This was also done for Group 2 on Glyphs and Bliss. In Figure 3 it is apparent that the performance on Glyphs was better in terms of correctly recognised symbols over all four stages of testing. After the first training phase (Test 1), Group 2 scored higher on the Glyphs (87% correct) than Group 1 did on Blissymbols (83%). The revision phase proved that Glyphs again had a higher percentage of symbols correctly identified (89%) compared to Bliss (88%). After seven days' withdrawal (withdrawal 1), Group 2 still recognised more Glyphs (91%) compared to the Bliss of Group 1 (83%). After 30 days of withdrawal (withdrawal 2) Group 2 identified 97% of the Glyphs correctly, compared to Group 1's 77% of correctly recognised Blissymbols. When Group 1 was exposed to Glyphs and Group 2 to Bliss, the subjects again performed better on the Glyphs than on Bliss. Irrespective of the group or the sequence of exposure, the subjects always performed better on Glyphs.

Table XXI: The average recognition of Group 1 and Group 2 on Blissymbols and CyberGlyphs

PROCEDURE	GROUP 1	GROUP 2
	Blissymbols	CyberGlyphs
Test 1: After first training phase	87%	93%
Revision (Rev): After second training phase	88%	95%
Withdrawal 1 (WD1): Re-testing after 7 days	83%	91%
Withdrawal 2 (WD2): Re-testing after 30 days	77%	90%
	CyberGlyphs	Blissymbols
Test 1: After first training phase	94%	81%
Revision (Rev): After second training phase	96%	88%
Withdrawal 1 (WD1): Re-testing after 7 days	89%	80%
Withdrawal 2 (WD2): Re-testing after 30 days	85%	75%

The performance of Group 1 in Bliss and Glyphs was determined by calculating how many of the 40 Blissymbols and 40 Glyphs taught to every individual were correctly recognised after the first teaching, the revision, withdrawal 1 and withdrawal 2. This was also done for Group 2 on Glyphs and Bliss. In Figure 3 it is apparent that the performance on Glyphs was better in terms of correctly recognised symbols over all four stages of testing. After the first training phase (test 1), Group 2 scored higher on the Glyphs (93% correct) than Group 1 did on Blissymbols (87%). The revision phase proved that Glyphs again had a higher percentage of symbols correctly identified (95%) compared to Bliss (88%). After seven days' withdrawal (withdrawal 1), Group 2 still recognised more Glyphs (91%) compared to the Bliss of Group 1 (83%). After 30 days of withdrawal (withdrawal 2) Group 2 identified 90% of the Glyphs correctly, compared to Group 1's 77% of correctly recognised Blissymbols. When Group 1 was exposed to Glyphs and Group 2 to Bliss, the subjects again performed better on the Glyphs than on Bliss. Irrespective of the group or the sequence of exposure, the subjects always performed better on Glyphs.



Test 1: First scores after first training session

* same concepts

Revision: Scores after revision

same concepts

WD 1: Scores after seven days of withdrawal

WD 2: Scores after 30 days of withdrawal

Figure 3: The performance of Groups 1 and 2 on Bliss and Glyphs

It was apparent from Figure 3 that the percentage of symbols retained in each symbol system consistently decreased as the period of withdrawal was extended. Firstly, Group 1 (Bliss) showed a 12% decline in performance from the revision test to the second withdrawal. Group 2 (Glyphs) showed a 5% decline. In the case where Group 1 was exposed to Glyphs, the group displayed an 11% decline and Group 2 (Bliss) displayed a 14% decline in performance. Although the degree of decline was larger in the first instance (12%), there was still a tendency for the group exposed to Glyphs to show less of a decline in retention than the group exposed to Bliss. This tendency might be due to the fact that Glyphs are hand-drawn and consist primarily of pictographs (Fuller *et. al.*, 1997) which this might facilitate the visual memory of the subjects.

It appears that the longer the period of withdrawal, the larger the difference in the performance between Bliss and Glyphs. After seven days of withdrawal there was a difference of 9% between the performance of Group 1 on Bliss and Group 2 on Glyphs. After 30 days of withdrawal there was a 13% difference between the performance of

Group 1 (Bliss) and Group 2 (Glyphs). After seven days of withdrawal there was a difference of 8% between Group 2 (Bliss) and Group 1 (Glyphs). After 30 days of withdrawal the difference was 10%. In Table XXII the results of the *t*-test are presented to illustrate the significance in the performances.

4.3. THE SIGNIFICANCE OF THE DIFFERENCES IN PERFORMANCE BETWEEN BLISS AND GLYPHS

4.3.1. Significance of the *t*-test scores

Table XXII: Standard deviation and *t*-values of the performance of Group 1 and Group 2.

GROUP 1 (Bliss) and GROUP 2 (Glyphs)								
	Test 1 (Bliss)	Test 1 (Glyphs)	Rev. (Bliss)	Rev. (Glyphs)	WD 1 (Bliss)	WD 1 (Glyphs)	WD 2 (Bliss)	WD 2 (Glyphs)
M	86.76	92.76	88.32	95.48	82.64	91.2	76.72	90.2
SD	8.6	5.8	8.3	6.4	9.3	7.4	7.7	7.8
<i>T</i>	2.35*		3.4***		3.5***		6.0***	
GROUP 1 (Glyphs) & GROUP 2 (Bliss)								
	Test 1 (Glyphs)	Test 1 (Bliss)	Rev. (Glyphs)	Rev. (Bliss)	WD 1 (Glyphs)	WD 1 (Bliss)	WD 2 (Glyphs)	WD 2 (Bliss)
M	94.16	81.48	95.72	88.44	88.64	80.2	85.12	74.92
SD	5.9	10.4	4.9	7.5	8.1	10.4	11.3	12.8
<i>T</i>	5.17***		3.97***		3.12***		2.93**	

M = Mean (percentage correct responses)

SD = Standard deviation

t = 2,01: Differences significant on 0,05 confidence interval

* = Significant on 0,05 level

t = 2,678: Differences significant on 0,01 confidence interval

df (degrees of freedom) = N1 + N2 - 2 = 48

The *t*-test results indicated that all the results (the differences in performance on Bliss and Glyphs) were significant. The differences in test 1 were significant on the 0,05 level of confidence and all the other results were significant on the 0,01 level of confidence. This means that there were significant differences in the performance of subjects between Glyphs and Bliss and that any differences that occurred were not coincidental.

4.4. PERFORMANCE IN DIFFERENT WORD CATEGORIES

The mean percentage for each word in each category was determined for all the sessions. Therefore, for each word, a value was calculated to see how many errors were made on individual words.

Paired *t*-tests were done to establish whether there were statistically significant differences between the mean percentage of errors between Bliss and Glyphs. These tests were done for nouns, verbs, adjectives, prepositions and pronouns. It is important to note that the sample sizes were small for prepositions and pronouns and the assumption of normality (necessary for the *t*-test) was not tested. The percentage of errors was measured on the same word but for each symbol system. Therefore, the samples were dependent and the paired *t*-tests were used.

The hypothesis tested was that the same average percentage of errors occurred for both Bliss and Glyphs, tested at four different times (training, revision, withdrawal 1, withdrawal 2), and included five different word categories. All results are discussed at the 5% significance level.

The averages used in the accompanying graphs, are therefore only for the number of concepts *incorrectly* identified during the last session (withdrawal 2), as this was regarded as the most relevant test indicating the level of retention for each specific symbol system. Table XXIII provides a summary of all the exceedance probabilities for each *t*-test result for the different word categories.

Table XXIII: *P* values or exceedance probabilities for the different word categories during all stages of testing

<i>p</i> values or exceedance probabilities for each of the 20 <i>t</i> -tests				
	Test 1	Test 2	Withdrawal 1	Withdrawal 2
Nouns	0.087	0.431	0.079	0.011*
Verbs	0.023*	0.023*	0.006*	0.003*
Adjectives	0.006*	0.001*	0.001*	0.000*
Prepositions	0.267	0.043*	0.500*	0.022*
Pronouns	0.003*	0.004*	0.002*	0.003*

Note: If the *p* value is < 0.05 then there is a significant difference at the 5% level. (indicated by *)

The results of the *t*-tests for each test and the percentage of errors on each word in each category are presented in Appendix I.

According to the results (especially at the last measurement – withdrawal 2) all word categories were better recognised for Glyphs than for Bliss. The results of the percentage of errors on the withdrawal 2 tests are presented in 4.4.1 – 4.4.5. for each word category. The values discussed in Table XXIII are derived from the following data presented in Figures 4 – 8.

4.4.1. Nouns

The performance on nouns for both symbol systems is discussed below. The graphic representation at the last withdrawal stage is illustrated in Figure 4.

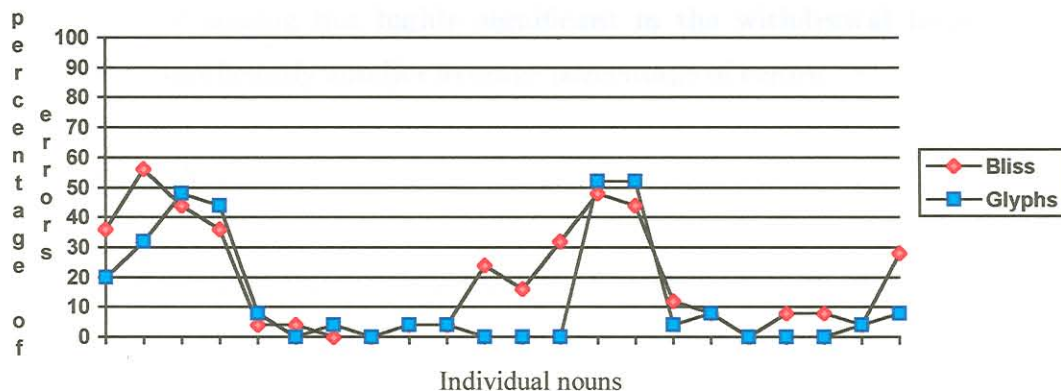


Figure 4: Percentage of errors in nouns for Bliss and Glyphs (withdrawal 2)

When comparing the average percentage of errors for both Bliss and Glyphs the following was found. There was a statistically significant difference between the two symbol systems for only the withdrawal 2 test. The average percentage of errors was significantly lower for Glyphs. The other three stages showed no statistically significant differences.

4.4.2. Verbs

The graphic representation at the last withdrawal stage is illustrated in Figure 5.

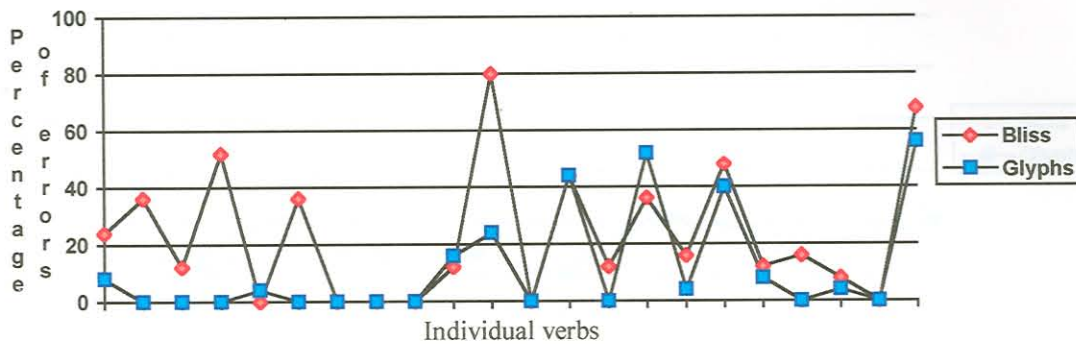


Figure 5: Percentage of errors in verbs for Bliss and Glyphs (withdrawal 2)

When comparing the average percentage of errors for Bliss and Glyphs the following was found. There were statistically significant differences between Bliss and Glyphs on all four stages of testing but highly significant in the withdrawal tests. Again Glyphs produced a significantly smaller average percentage of errors.

4.4.3. Adjectives

The graphic representation at the last withdrawal stage is illustrated in Figure 6.

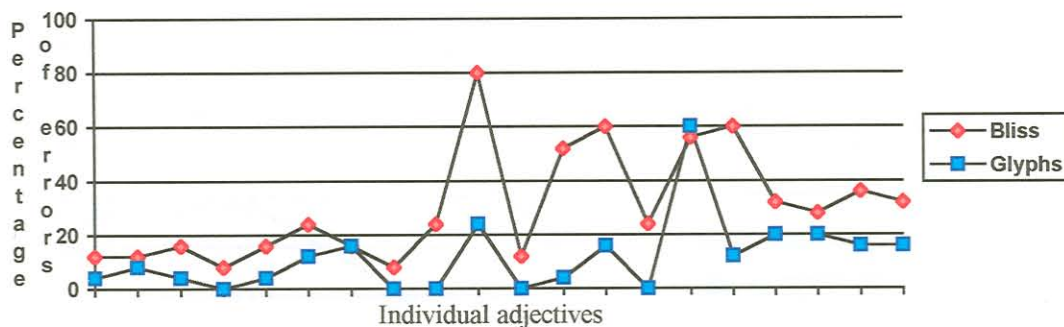


Figure 6: Percentage of errors in adjectives for Bliss and Glyphs (withdrawal 2)

When comparing the average percentage of errors for Bliss and Glyphs the following was found. There were highly significant differences between Bliss and Glyphs in all four stages of testing where Glyphs produced a significantly smaller average percentage of errors.

4.4.4. Prepositions

The graphic representation at the last withdrawal stage is illustrated in Figure 7.

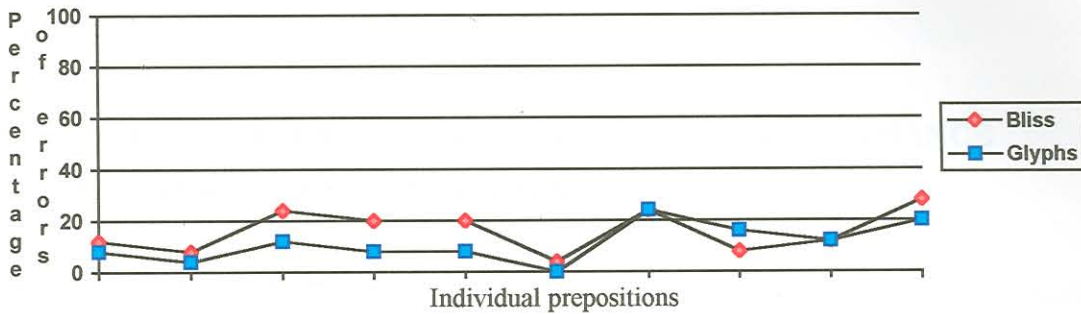


Figure 7: Percentage of errors in prepositions for Bliss and Glyphs (withdrawal 2)

When comparing the average percentage of errors for Bliss and Glyphs the following was found. There was a statistically significant difference between Bliss and Glyphs for only test 1 and withdrawal 2. The average percentage of errors was significantly lower for Glyphs. The other two tests (revision and withdrawal 1) showed no statistically significant differences in average percentage of errors.

4.4.5. Pronouns

The graphic representation at the last withdrawal stage is illustrated in Figure 8.

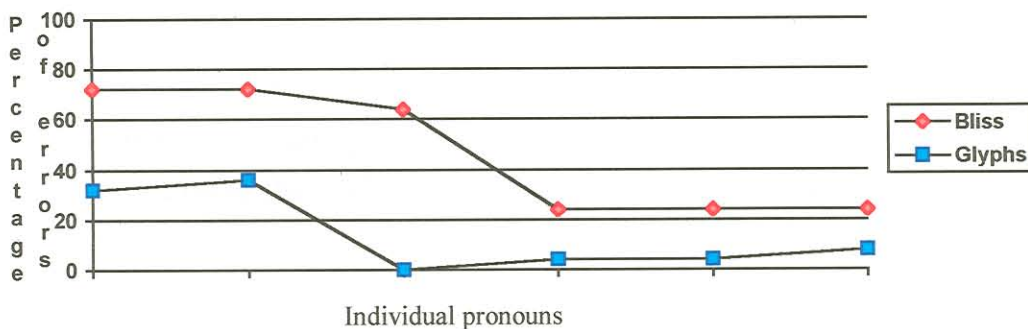
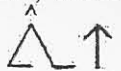

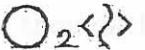



Figure 8: Percentage of errors in pronouns for Bliss and Glyphs (withdrawal 2)



When comparing the average percentage of errors for Bliss and Glyphs the following was found. Again there were statistically significant differences between Bliss and Glyphs in all four different stages of testing where Glyphs again produced a significantly smaller average percentage of errors.

The reason for the overall better performance of Glyphs might lie in the factors influencing learnability, like iconicity, semantic transparency/translucency and/or complexity as well as cultural factors.




4.5. POSSIBLE FACTORS INFLUENCING THE PERFORMANCE BETWEEN BLISS AND GLYPHS

It could be argued that the semantic transparency/translucency of Glyphs is higher than that of Bliss. This means that the composite meaning of the symbol components and the meaning of the symbol referent of Glyphs might be more in a relationship of agreement for the majority of the CyberGlyphs than for that of Bliss. It is possible that the different components of some of the Glyphs have a more direct relationship to the referent. In the example “climb”, the Blissymbol consists of an action indicator, legs and an arrow pointing upwards (). The CyberGlyphs symbol consists of an action indicator, a set of stairs and a simple line drawing of a man ascending the stairs (). In this instance it is easier to perceive the relationship between the different elements of Glyphs to be related to the word “climb”. There are instances, however, when the Blissymbol seems to have a higher semantic transparency/translucency value. An example would be “summer”. The Blissymbol () consists of a circle depicting the sun, the number “2”, as well as the symbol for “hot”. The Glyph symbol for “summer” () is four rectangular shapes with the second block marked with an X (which means that the second season is indicated). There are more information-carrying parts in the particular Blissymbol than in the Glyph symbol. The results indicate that 55% of the Blissymbols were correctly identified as opposed to 42% of the Glyphs.



The prototypicality of the referents in Glyphs may be higher than for Bliss, as some of the Glyph symbols are more pictographic and the potential for being more ambiguous is less. It is therefore easier to guess the “target referent” when there are more definite (pictographic) clues to the symbol’s meaning. The higher number of pictographic symbols of Glyphs also results in a higher semantic transparency/translucency value than that of



Bliss [e.g. “car” () in Glyphs clearly depicts a car, where the Blissymbol () consists of two wheels and a steering wheel].

Carmeli and Shen (1998) state that semantic translucency/transparency and prototypicality are strongly related. Prototypicality increases the guessability of the target referents from amongst other possibilities. When clarity of message is the objective, it can be said that uniqueness of the referent would be even better than prototypicality to enable an unambiguous message. Uniqueness refers to a symbol that depicts a distinctive feature of the referent (see 2.3.2). It is assumed that uniqueness of referents increase semantic transparency/translucency. However, Bliss seems to rely more on prototypicality in some cases than on uniqueness to enable the economising of the number of symbol components. Uniqueness requires multi-component symbols to increase the informativeness of the symbols. This raises the question whether Glyphs have a higher level of uniqueness and/or are the symbols simply higher in prototypicality than Blissymbols?

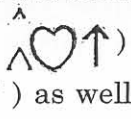




When a symbol like “nurse” () is used, the Blissymbol has three different components (person + protection + medical). The symbol for “nurse” () in Glyphs has two basic components (female + syringe). When it is to be decided between “the medical person providing protection” and “the woman with the syringe” as representing “nurse”, the latter seems to be the logical choice. Even though the Blissymbol has more components, the uniqueness of the symbol is lower than that of the Glyph, but it does have a high degree of prototypicality. It is important to note that prototypicality is culture dependent. A prototype for one culture may not necessarily be a prototype for another culture. For a Northern Sotho or Zulu person from a rural background, the prototype of the symbol ( “basin”) might be “calabash” – a typical container in which water is carried from wells or streams. A washbasin is not a familiar concept for them but for a person from an urban background the prototype for “container” and “water” might be “basin”.

There might be more semantic logic contained in the Glyph symbols. For example, there are more logical clues to indicate gender in the pronouns of Glyphs (“she” has long hair:

 ; where “he” has short hair: ). In the case of Bliss the difference is

suggested by “she” having a skirt to indicate gender:  ; or only legs (or pants) to indicate “he”:  . The inclusion of the number 3 to indicate the third person is a more difficult linguistic concept that only seems logical when one has a thorough grammatical knowledge of the language.

There is currently no research available on the visual complexity of CyberGlyphs. When looking at the visual complexity, it appears that Bliss has more geometric shapes than Glyphs, which makes Bliss more minimalistic. Glyphs seems to be a more naturalistic and “user friendly” system, as the symbols are hand drawn. The number of geometric shapes of the Blissymbols might have been more intimidating for the children and might have given an impression of strange, abstract objects in comparison to the Glyphs, which has a more “natural”, hand-drawn appearance. Although Glyphs do contain some abstract shapes, there are quite a few symbols that represent line drawings of the concepts rather than geometric shapes. It may be concluded that some Glyphs were easier to identify than Bliss because of the pictographic nature of a number of the symbols.

The compound symbols in Bliss are formed by combining the key elements that make up the whole symbol, e.g. “play” () consists of the symbol for activity () and the symbol for happiness () as well as the action indicator (). The concept is analysed as “activity” + “happy” + “action indicator” = to play. In Glyphs, the action is depicted through a pictograph (), rather than analysing the meaning of the word “play”. It seems that Glyphs has a more holistic approach to its symbols and Bliss has a more analytical approach, which is the tendency in most of the Blissymbols.

The iconicity ratings gave an indication that Glyphs had a higher mean percentage rating than Bliss. Therefore, Glyphs were found to be more iconic than Bliss and consequently easier to learn. However, when one investigates the different word categories, Glyphs is not more iconic than Bliss in every category. Iconicity ratings are inconsistent over different word categories as iconicity for adjectives were rated lower for Glyphs, but still Glyphs performed significantly better on adjectives (Figure 6). Pronouns and prepositions were rated equal. However, it is apparent that the smaller sample sizes for pronouns and prepositions might be an influencing factor. Another

factor might be the cultural differences between the raters and the subjects used in the study. Being adults from a different cultural background, the raters might have rated the iconicity differently from the way in which the children would have. It seems that iconicity, complexity and semantic transparency/translucency play a role in the learnability and recognition of symbols. Cultural factors also play a major role and should be carefully considered when analysing and interpreting data.

4.1. INTRODUCTION

4.6. SUMMARY

This chapter provides a summary of the results obtained as well as conclusions. This is

The findings of the research were presented in this chapter. The following observations were made:

- Glyphs had an overall better performance in learning and recognition of symbols.
- Glyphs had significantly fewer errors in all the word categories.
- Glyphs rated higher than Bliss on iconicity for nouns and verbs, but lower on adjectives. The ratings of pronouns and prepositions were the same.

One of the aims of learning and recognition. Two homogeneous groups of Northern Sotho speaking children were taught a total of 80 symbols each – 40 Blissymbols and 40 Cyberglyphs. After the training the subjects were requested to match the correct symbol with the appropriate concept. They were tested on the number of symbols they could remember after training, as well as after the revision session. The subjects were tested again after a seven-day withdrawal period, and again after a 30-day withdrawal period to determine how many symbols were recognised.

In the present study the learnability and memory retention of the Cyberglyphs were higher than for Blissymbols. Comparisons were made on the performance in the different word categories to investigate the impact of different word categories on the ease of learnability and recognition.

When the individual word categories were analysed, the performance in all the word categories for Glyphs was better than the performance for Bliss. This correlated with the higher iconicity ratings given by five raters for nouns and verbs in Glyphs. Even