CHAPTER 2
THEORETICAL BACKGROUND

2.1 INTRODUCTION

As stated in Chapter 1, there is a significant discrepancy in communication rate between AAC users and natural speakers. AAC teams have consequently developed a number of encoding and retrieval strategies to enhance the rate of communication. Each of these techniques potentially has its own set of prerequisite skill requirements to enable the user to benefit from the technique, e.g. a person needs adequate visual memory to use a specific visual memory encoding strategy as a means of rate enhancement. However, the complexity of abilities and skills required for effective implementation of specific rate enhancement techniques (RETs) have not yet been adequately researched. Interventionists need to systematically investigate these skills and find innovative ways of dealing with the skill requirements of rate enhancement techniques. The majority of rate enhancement techniques are technology driven and their skill requirements are dependent on the extent to which they comply with the laws of applying technology (Quist and Lloyd, 1997, pp.121–126). Chapter 2 will commence with a discussion of some of these laws and a discussion of different rate enhancement techniques, focusing on the technique that is relevant for this study, iconic encoding. This will be followed by a reflection on the cognitive demands associated with the use of rate enhancement techniques. Different aspects relevant to iconic encoding will be examined, including different types of associations, different semantic fields and the impact of culture on symbol learning. A discussion of the features of Unity™ will conclude the chapter.

2.2 THE LAWS FOR IMPLEMENTING TECHNOLOGY

Quist and Lloyd (1997, pp.121-126) proposed a number of laws that should be adhered to when implementing technology, including the law of practicality and use, the law of parsimony, the law of best fit and the laws of minimal learning, minimal energy, and minimal interference. Some of these laws have specific importance for the current study. The **law of parsimony** suggests that during the implementation of technology, procedures should be made "as simple as possible" (Quist and Lloyd, 1997, p.121). According to this law, when

selecting and implementing technology – especially for the purpose of rate enhancement – the AAC systems being considered should not be too elaborate, in order to prevent liabilities in terms of cost and lack of portability. When selecting a rate enhancement approach to use with the proposed technology, the **law of minimal learning** should be pursued. It is preferable to implement an approach that can be used with little or no learning (Quist and Lloyd, 1997, p.121). This implies that when an iconic encoding technique like Minspeak™ is implemented the icons and the vocabulary coded with these icons should not inflict high demands on the user in terms of learning. Trying to memorize different icon codes and icon sequences may contribute to increased cognitive demands leading to high levels of fatigue that may interfere with the speed and accuracy of communication.

The **law of minimal energy** proposes that any activity should be carried out with as little effort as possible, so that it can be sustained for longer periods of time. If learning and recalling the codes to retrieve prestored messages requires too much mental energy from the user, the effectiveness of the rate enhancement technique is undermined. When the skill and output requirements are too high AAC users tend to use their technology options less (Quist and Lloyd, 1997, p.123). The **law of minimal interference** postulate that the approach that is implemented should not divert the user's attention from ongoing activities (Quist and Lloyd, 1997, p.123). These activities might include interactional, communicative, vocational, educational or other activities, where the user is required to focus his attention on various other (more important) issues. It follows that if a user has to focus too much attention on remembering codes for retrieval of prestored messages, it might impede his participation in other activities. Interventionists need to investigate the different strategies used to enhance the rate of communication and the demands that these strategies inflict on the user.

2.3 RATE ENHANCEMENT TECHNIQUES (RETs)

One of several factors contributing to the slow rate of communication of AAC users, is that these communicators are often required to compose their messages by selecting symbols, words, pictures or letters one at a time (Beukelman and Mirenda, 1998, p.74). The process of for instance spelling out words - letter by letter - is time consuming and makes it difficult for the user to keep the communication partner interested and remember how far the message is composed. Often the effectiveness of communication is compromised and the main purposes of communication are not fulfilled. These purposes were identified by Light (1988) as social

closeness, transfer of information, making needs and wants known, as well as social etiquette. When the rate of communication is slow, it might induce various social, cognitive, and probably physical demands on the AAC user and/or his communication partner. With regard to the laws for implementing technology, the laws of minimal learning, minimal energy and minimal interference are all violated. According to these laws, the rate of communication should be enhanced and at least some of the demands lessened, but it can only be done if *effective* rate enhancement techniques are implemented.

Rate enhancement techniques refer to those techniques implemented by AAC users, that result in "the number of characters generated being greater that the number of selections the individual makes" (Cook and Hussey, 1995, p.488). It follows that the user has to make fewer selections, and subsequently the overall rate of communication is increased. A substantial body of research on rate enhancement techniques has been accumulated over the last 3 decades. Table 2-1 is a summary of some research on rate enhancement techniques.

Research, using both disabled and able-bodied persons, has centred around both encoding and prediction techniques, focussing on factors influencing the effectiveness of implementing rate enhancement techniques. These factors included the cognitive demands inflicted upon the user, the average number of *selections* required to communicate a *message*, the average number of *keystrokes* required to make a *selection*, the duration of message production, etc. Theoretical studies on rate enhancement techniques typically examined the number of keystrokes needed for composing a message when making use of different encoding techniques. Factors that are influenced by human characteristics are often not heeded, as these might seem more subjective and more difficult to measure reliably. These characteristics include the user's motor and sensory skills, the style of learning, and fatigue levels. Few studies pertaining to the influence of the user's culture on the use of RETs, could be located. These studies typically emphasise that keeping the individual's culture in mind is a fundamental principle for clinical practice, but few provide guidelines on how to make assessment and intervention practices more culturally congruent. Huer (2000) investigated three aided graphic symbol sets to determine the impact of participants' culture on how they perceive graphic representations. The results of her study, albeit preliminary, suggested that manufacturers of commercially available AAC graphic representational sets and systems should keep the effect of culture in mind when developing products, as perceptions of symbol meanings are likely to vary as a function of culture (Huer, 2000, p.184).

Table 2-1: Summary of research on rate enhancement techniques

Researcher(s)	Year	Title	Main aims of research	Participants	Method	Results
Light et al	1990	The effects of message encoding techniques on recall by literate adults using AAC systems	To determine the effectiveness of code recall using 3 encoding techniques, as well as the probable cognitive processing demands inflicted when using 3 different message encoding techniques and the influence of imageability or concreteness on recall accuracy	6 nonspeaking, functionally literate, physically disabled adult AAC-users	Within-subjects design with repeated measures required participants to learn and recall codes of messages using 3 different encoding techniques, including salient letter codes, letter category codes and iconic encoding	Too many methodological problems were identified by the authors (Light et al., 1990, p.196) and their peers (Williams, 1990, pp.290-293) to make any conclusive claims.
Light & Lindsay	1992	Message-encoding techniques for augmentative communication systems: The recall performances of adults with severe speech impairments.	To investigate the effect of different factors on the ease of learning and the accuracy and speed of recall, including the type of encoding technique, level of personalization and the level of abstractness of the message involved.	12 non-speaking, physically disabled adults	6 counter-balanced experimental conditions were used. Every subject was subjected to six sessions, consisting of an introductory session, 4 learning sessions and a final probe session. Subjects had to learn the codes for 80 messages including both abstract and more concrete messages. The accuracy and speed was recorded during the 4 learning sessions.	Subjects were more accurate in recalling the codes by letter encoding techniques, than by using iconic encoding techniques. Code recall improved consistently across the series of learning sessions and there were no significant differences in the rate of learning across the encoding techniques.
Goossens', Elder & Bray	1990	Validity of the semantic compaction competency profile in normally developing preschool children.	To determine whether the Semantic Compaction Competency Scale was an effective and valid instrument for screening potential semantic compaction users' potential	Normally developing preschool children	Individuals were asked to recognise a small set of coloured objects by name and various questions were asked requiring different types of associations.	Although some problems were identified, it seems that the scale provides the intervention team with a reliable idea of the person's associational abilities and enables them to make predictions as to the appropriateness of VOCAs based on the semantic compaction principle.
Huer	2000	Examining perceptions of graphic symbols across cultures: Preliminary study of the impact of culture/ethnicity	To study the impact of culture/ethnicity on graphic symbol recognition and to describe implications for the practice of AAC across cultures	147 participants between the ages of 30 – 64 years who identified themselves as African-American, Chinese, European-American or Mexican	Graphic symbols from a 41-item lexicon, with translated referents, were rated on a 7-point scale of iconicity. Three graphic representation systems were used, including Blissymbols, Dynasyms and Picture Communication Symbols.	Results indicated that individuals from different cultures perceive graphic representations differently. Even though there were differences found, there were also similarities, as there were a tendency of participants to find Bliss more difficult than the other systems.
Vanderheiden & Kelso	1987	Comparative analysis of fixed-vocabulary communication acceleration techniques	To provide a presentation of the basic concepts, issues and data, regarding the impact of various types of "acceleration word sets" (rate enhancement techniques). The above-mentioned discussions are used as a basis for an analysis of several abbreviation-expansion approaches as well as the relationship of fixed-vocabulary spelling prediction techniques.	None - theoretical analysis	Theoretical analysis of the percentage of keystrokes that would be saved through the use of various encoding techniques	Depending on the kind of encoding, keystroke savings might range between 20 and 50 % compared with letter-by-letter typing. Word length had to be considered as the longer the word, the greater the key stroke savings, since long words require more letters. The research has suggested that the keystroke savings for message prediction systems would not likely exceed those achieved through encoding.

Table 2-1: Summary of research on rate enhancement techniques (continued)

Researcher(s)	Year	Title	Main aim of research	Participants	Method	Results
Higginbotham	1992	Evaluation of keystroke savings across five assistive communication technologies.	To compare keystroke efficiency for different encoding and prediction techniques over 20 randomly selected essays from students from the local county	Essays were typed, using each of the following strategies: • EZ Keys (Words+) • Words Strategy (Prentke Romich Company) • Predictive Linguistic Program (Don Johnson) • Write 100 (Goodenough-Trepagnier et al., 1982) • Generic Encoding Technology software (Vanderheiden, 1988)	Twenty 500-word text passages were typed using each of the techniques and the number of keystrokes were analysed in several ways	Keystroke savings of between 35 and 50 % are possible with most rate enhancement software available for both MS-DOS and AAC systems
Venkatagiri	1994	Window size in lexical prediction	To examine the effect of the size of the menu offered in word prediction programmes, including menu size of 5, 10 and 15 words.	Participants without disabilities	A writing task had to be completed with the different menu window sizes	The message preparation time in the 15-word menu was equal to that in the 5-word menu. The rate of prediction was the highest and the amount of keystrokes required the lowest in the 15-word menu. This indicated that larger menus could have clear advantages, especially where fatigue impacts negatively on a particular individual's communication.
Venkatagiri	1995	Techniques for enhancing communication productivity in AAC: A review of research	Six approaches were reviewed and rated, using seven criteria: learning needs, cognitive-linguistic processing requirements, motor requirements, perceptual requirements, size of vocabulary, rate increase potential and availability	Six approaches were reviewed (efficient keyboard layouts, reduced keys keyboards, Minspeak with Words Strategy, enlarged keys keyboards, abbreviation expansion, and lexical prediction)	Theoretical analysis	For literate adults, the alternative keyboards offered a simple and cost-effective technique that rated high on all 7 of the criteria. The other approaches were found to have both significant advantages and drawbacks, that need to be considered for every user individually.
Koester & Levine	1996	Effect of a word prediction feature on user performance	To determine the impact of the word prediction feature on user performance in terms of rate, accuracy and frustration of users.	6 men with cervical spinal cord injuries and 8 able-bodied men	All participants were given comparable sentences to transcribe with a standard keyboard and a mouthstick using either letter-only or letter-plus-word prediction, in which 6 numerically coded words appeared on the screen when letters were typed	The benefits of any keystroke savings for the word prediction system were generally offset or even exceeded by the keystroke cost of making each selection. Much time was spent searching the menus and both groups of participants rated the letters-plus-word prediction strategy as more difficult than the words-only strategy. The former strategy might have placed more cognitive demands on the participants.

There are at least two broad categories of rate enhancement techniques (RETs), namely encoding techniques and prediction techniques (Cook and Hussey, 1995, p.488).

Encoding refers to the way in which certain codes are associated with specific messages and encoding techniques could include any technique where the AAC user selects multiple symbols to transmit the desired message (Vanderheiden and Lloyd, 1986; Beukelman and Mirenda, 1998, p.78). Encoding is generally defined as the formulation of language when the communicator formulates his message by recalling and retrieving symbols or a combination of symbols from the brain and arranging them in semantic categories in "syntactical rule-governed order" (Quist and Lloyd, 1997, p.117). The entire encoding process is typically carried out with little or no conscious thought about the process and is usually completed instantaneously (Quist and Lloyd, 1997, p.117). However, this process seems to be different for AAC users, as an additional process is included, by which messages are stored in association with a specific symbol or symbol sequence for later retrieval (Beukelman and Mirenda, 1992; Musselwhite and St. Louis, 1988; Silverman, 1995). These symbols need to exist both in the brain's linguistic areas and in an external location like a computer's memory, on an ETRAN, or on a communication board.

Prediction techniques refer to techniques that decrease the options available to the user, i.e. predicting what is available and thus increasing rate of communication, as the user does not have to select from that many options. Prediction techniques include both word prediction and techniques like icon prediction. Word prediction is a specialised technique that presents menus of possible words each time the AAC user types a letter. These lists are based on words that are frequently used by the general population and are often adjusted to include the individual's most frequently used words (Quist and Lloyd, 1997, pp.120-121). For instance if the individual type "ro", a menu of five different options appears on the liquid crystal display, e.g. *roly-poly, rope, rose, rough,* and *round.* The user has to select the desired choice, by for instance selecting the item's number. A distinct advantage of word prediction strategies is that the user is not required to memorize any codes. Icon prediction is a feature that aids the recall of stored messages, using a light connected to each symbol in the selection set. Only those symbols which form the beginning of an icon sequence are lighted initially, thus the user knows which symbols are possible first icons. When an icon is selected, only those lights which are part of a sequence beginning with the selected icon are illuminated. This process continues until a complete icon sequence has been selected. Icon prediction is a further rate

enhancement technique which increases selection accuracy and reduces errors as the allowed selection set is decreased for any given choice.

Both encoding and prediction techniques are generally employed to address problems like poor message composition (e.g. spelling or grammatical errors) or poor timing (e.g. an interjection expressed three minutes after the occurrence, causing it to be inappropriate and causing breakdowns in communication). Therefore encoding and prediction techniques are primarily implemented for three main purposes: to enhance timing, to assist grammatical formulation of messages and to enhance communication rates (Beukelman and Mirenda, 1998, p.85). Timing of messages can be enhanced if the code for a certain message is easy to recall and easy to select, thus achieving rate enhancement and ensuring that a message is transmitted while it is still relevant to the situation. Often grammatical correctness of messages composed in a hurry is compromised due to timing requirements. The selection of prestored messages or messages from a word prediction programme could alleviate this problem. Encoding techniques are more widely used in the South African context than prediction techniques, and will now be discussed in more detail.

2.4 ENCODING STRATEGIES AS RATE ENHANCEMENT TECHNIQUE

Various authors have written at length about different types of encoding strategies (Lloyd, Fuller and Arvidson, 1997; Beukelman and Mirenda, 1998; Cook and Hussey, 1995; Silverman, 1995; Musselwhite and St. Louis, 1988; Vanderheiden and Lloyd, 1986). Five broad categories can be identified based on retrieval methods: visual-motor encoding, memory-based encoding, chart-based encoding, display-based encoding, and semantic and conceptual encoding.

Visual-motor encoding is a form of conceptual encoding that makes use of diagrams or visual representations that illustrate hand movements. These visual representations are related to motor components of gestures that represent meaning (Quist and Lloyd, 1997, p.117). It is based on "significant parameters of manual sign production", viz. location, movement and handshape, as opposed to conceptual associations that have specific relevance in a signing context. For example, a system like VoisShapes™ - a hi-tech visual-motor encoding system - implements a three-hit sequence of the above-mentioned parameters to retrieve prestored words corresponding to manual signs (Quist and Lloyd, 1997, p.120).

Memory-based encoding requires the AAC user to memorise the codes associated with specific messages. This can be accomplished by rote learning e.g. for numeric encoding, or through using mnemonic strategies that aid recall, e.g. salient letter encoding or letter-category encoding (Beukelman and Mirenda, 1998, p.79). In some cases both the user and the communication partners should know the codes by memory, e.g. auditory scanning, eye movements, hand signs, etc. (Cook and Hussey, 1995, p.489). Examples of encoding strategies that are memory-based are:

- *Colour coding* where colour is used to encode messages, usually in conjunction with specifiers like numbers or symbols - especially useful for eye-pointing communication systems (Goossens' and Crain, 1986, 1987);
- *Salient letter encoding/Logical letter encoding* which makes use of the initial letters of the primary words in a sentence to construct the code, e.g. OW for "please **o**pen the **w**indow";
- *Letter-category encoding* where the initial letter of a code is determined by an organizational scheme that categorises messages, e.g. initial letter E for a category "eating" would include messages like "please cut my meat, I need some salt, yummy, I'm done";
- *Alpha-numeric encoding* which uses a selection of codes that include both letters and numbers. The letter-part is used to code category, e.g. G for greetings, and the number-part is used arbitrarily to specify individual messages;
- *Numeric encoding* which makes use of a completely arbitrary code for a corresponding message. The code can be used to represent a word or even a complete phrase or sentence. The user merely enters one or more numbers, and the device outputs the complete stored vocabulary item. The advantage of numeric encoding is that it requires fewer selections and the codes can be memorised, a display is not required. The disadvantage is that it is very arbitrary, which increases the memory load.

Chart-based encoding includes techniques that have an index of the codes and what each code represents e.g. an organised chart on the wall or a key of reference in the form of a paper next to a communication board/device (e.g. look up = yes) for explaining codes during communication (Cook and Hussey, 1995, p.489; Quist and Lloyd, 1997, p.117).

Display-based encoding is similar to chart-based techniques, but the individual responds to the display without any reference to a code i.e. responding to the selection set to enter a code, e.g. a 2-way switch when using Morse code (left = dash; right = dot) (Quist and Lloyd, 1997, p.117; Cook and Hussey, 1995, p.489).

Semantic and conceptual encoding/iconic encoding makes use of symbols that have a natural and/or taught association with their referents and it typically involves associating multiple meanings with graphic symbols, called icons (Quist and Lloyd, 1997, p.117). Iconic encoding is widely used with VOCAs around the world and is available in a number of aided communication products, including the DigiVox™ (Sentient Systems Technology Inc.); the ChatBox™ (Saltillo); the Macaw (Zygo Industries Inc.); the AlphaTalker™ (Prentke Romich Company); Ke:nx™ (Don Johnson Inc.); the DeltaTalker™ (Prentke Romich Company); Talking Screen™ (Words+ Inc.); the Liberator II™ (PRC); the Vanguard™ (PRC); the Pathfinder™ (PRC), as well as previously manufactured devices like the IntroTalker™, LightTalker™ and TouchTalker™ (Prentke Romich Company). The last three devices are mentioned here as they are frequently imported to South Africa as refurbished devices, making them more affordable. The iconic encoding technique that is most often found when viewing all of the above-mentioned options, is semantic compaction or Minspeak™. This type of encoding will be discussed in more detail due to its relevance to the present study.

2.5 ICONIC ENCODING

Baker (1982, 1986) proposed an iconic encoding technique referred to as semantic compaction, or Minspeak™ as it is known commercially. "Minspeak" is an acronym for minimum effort speech (Bruno, 1989, p.89). The techniques uses multi-meaning icons (i.e. pictorial symbols) in sequences which code words, phrases and sentences on the basis of their meanings (Cook and Hussey, 1995, p.490; Van Tatenhove, 1993). Sequences of icons are combined to store word, phrase or sentence messages in one of the voice-output devices constructed to incorporate this technique. Icons used for this type of encoding are deliberately selected for their rich semantic associations. Using iconic encoding, messages can be semantically organised by activities, topics, locations or other categories to enhance retrieval (Beukelman & Mirenda, 1998, p.77). This system was designed to represent large vocabularies (Baker, Schwartz and Conti, 1990).

Minspeak™ uses a closed set of multi-meaning icons in sequences to code language as the manufacturers anticipated that single-meaning iconic systems require many hundreds of different pictures to represent even the "barest lexicon" (Baker et al., 1990). The use of icons with multiple meanings allows for the expansion of programmed messages with regard to flexibility and richness of associations (Quist and Lloyd, 1997, p.120). Each icon links to

certain elements of the English language. The different icons included in Minspeak™ relate to each other in ways that are understood when viewing the associations made with certain icons. The icons are used as the shortest possible means to represent, syntactically and semantically, the content of the user's native language (Baker et al., 1990). The semantic compaction approach includes the use of similes, metaphors and categories of a language for "consistent, mnemonic and representational purposes" (Baker et al., 1990). The different messages that are prestored, are analysed to identify a maximum of three different concepts and an appropriate sequence of icons is selected to represent or code these concepts (Light et al., 1990, p.186).

Very little material has been formally presented to describe the sequencing procedures used with icons, although this work has always been viewed as important in semantic compaction (Baker et al., 1990). How individual icons and icon sequences relate to different language elements within the semantic compaction approach, has been the subject of much discussion and formal presentation. The different order of certain icon sequences allows semantic compaction to clarify the meaning represented either directly, or indirectly through association, on the other icon. This potential to clarify or "disambiguate" is a powerful tool for brevity (Baker et al., 1990).

Central to semantic compaction is the principle that any icon is embedded in a range of metaphors, relationships and categories, which are then used for representational purposes. When this range of metaphors, relationships and categories are unknown to the user, it may have a negative impact on the ease with which the messages coded by the icons are learnt and recalled. This might also inflict a much higher memory load on the user, which may in turn decrease the rate of communication, thus undermining the purpose of the rate enhancement technique. The effectiveness of any encoding technique relies heavily on the speed, accuracy and ease of learning and recalling codes for message retrieval (Light et al., 1990, p.184). When the ease of learning and recalling of the message codes are decreased, the effectiveness of the rate enhancement technique is also diminished.

However, unknown metaphors, categories and relationships are not the only potential cognitive demands facing users wanting to learn the principles of semantic compaction. Using more sophisticated VOCAs makes various demands on memory (Oxley and Norris, 2000, p.79; Levelt, 1995, pp.18-20; Light and Lindsay, 1991, pp.186-187). In order to use

Minspeak-based VOCAs effectively, the AAC user is required to, amongst other things (a) memorise the available vocabulary for future use; (b) understand and learn how the programmer has associated each vocabulary unit with an icon; (c) memorise the necessary vocabulary; (d) make effective use of this information during spontaneous interaction; and (e) select an appropriate retrieval strategy and execute it successfully to elicit the desired messages during interaction (based on Oxley and Norris, 2000, p.79). The cognitive processing demands associated with the encoding technique and the time consumed in selecting a specific code are crucial elements in effective rate enhancement. The potential rate enhancement of an AAC-user's communication can only be realised if the afore-mentioned demands are not present in excess (Light et al., 1990, p.184).

In iconic encoding strategies, the semantic associations with icons assist with retrieval, as do the icon prediction lights available on some electronic communication systems (e.g. Liberator™, PRC) to diminish the cognitive demands inflicted on the user. Despite advantages of recall provided by the Minspeak™ technique, when large numbers of sentences, words and phrases are stored the icon sequences can become difficult to remember, thus diminishing memory performance (Cook and Hussey, 1995, p.493).

Different variables influence memory performance as can be seen from the processes involved in interactional demands, where the user has to divide his attention between listening and watching the communication partner, processing the message, formulating a response, staying in a correct, upright position, and accessing the VOCA. Other variables include the amount of cognitive effort available for the task, the structure and organisation of the individual's memory (for children episodic memory and for adults semantic memory), the individual's knowledge of the importance and the use of strategies to enhance memory tasks). In addition, the need for executing a deliberate action inflicts more cognitive demands than perfoming an automatic action (Oxley and Norris, 2000, p.80-81). If children cannot remember whether a VOCA contains a certain message, they might be able to use a graphic representational overlay as an aid to memory, i.e. using the cues present on the overlay to remind them of the message information (Oxley and Norris, 2000, p.89). This does not only apply to children but virtually any person and to most AAC users.

There are two possibilities pertaining to the underlying cognitive processes of retrieving prestored messages using an iconic encoding technique like Minspeak (Light et al., 1990,

p.194). The first possibility suggests that iconic techniques relies primarily on recognition of the different code elements rather than on the recall of such elements. This might simplify or alleviate the cognitive demands on the user (Baker, 1985). The second possibility suggest that retrieval relies on recall, where the overlay on the VOCA serves as a retrieval cue for the recall of the correct icon sequence (Light et al., 1990, p.194). It is not clear whether the use of iconic encoding techniques requires recall of message content on an auditory level or if the user is able to recall the code based on the visual images and associations, thus directly from the contextual cue. However, expertise in specific area seem to affect memory performance positively (Chi, 1985; Rabinowitz and Glaser, 1985). Therefore, when people are familiar with certain aspects of activities, objects or more abstract concepts represented by an icon, the cognitive demands might be less and memory performance might increase. Similarly, if the user is unfamiliar with the specific concepts represented, the user is required to first learn these concepts and try to understand and remember the various relationships with the specific icon's meaning, and thus form a forced association. The cognitive demands inflicted when trying to learn something of which you have no experience whatsoever, is very high. Considering the other factors impacting on the user's memory, interventionists working with AAC systems based on graphic representational encoding systems – like the Minspeak-based VOCAs – need to ensure that the graphics and the associations used and learnt in connection with those graphics are familiar to the user. Thus, we need to determine whether the user has experience and therefore the relevant information in their semantic and/or episodic memory.

Although there is no "typical" AAC-user, people with severe speech and physical disabilities often have two areas of impairment affecting these areas of development significantly, viz. they lack the rich interactional experiences including the "fast, novel, self-initiated stream of expressive utterances" that is possible through speech; and their world knowledge could either be limited or cognitively differently organised, because of their different motor and sensory abilities (McNaughton and Lindsay, 1995, p.213). Thus, no interventionist can simply assume that a specific graphic representation is familiar and meaningful to a specific user.

Although more information is required, it seems possible that both recall and recognition might be active. It depends on the recall for retrieval of the correct code whilst the icon set acts as a cue for retrieval during recall. Simultaneously, recognition is used for selecting the specific relevant visual features of the icons that are available for message composition. The

process thus includes the following: the AAC-user composes a message cognitively; thinks of the potential message content and categorises the message (e.g. food-related = APPLE-icon, interaction-related = SENTENCE-icon) and cognitively starts eliminating irrelevant icons with the aid of icon prediction. The user now selects the specific category's icon (e.g. the APPLE-icon) and carefully studies the remaining icons' visual features (the remaining icons are illuminated according to icon prediction) to make appropriate associations based on information from his semantic and episodic memory. The next icon is now selected and this procedure continues until the full icon sequence has been selected.

The iconicity of a graphic representation seems to be a predictive factor in facilitating recall of symbols and thus retrieving the prestored messages coded by the symbol (Paivio, 1986). Thus, iconicity could influence the learnability of an icon as well as the cognitive demands inflicted on the user who is trying to learn the associations and the codes for storing and retrieving prestored messages (Luftig, 1983; Blau, 1983; Schlosser, 1994). Iconicity has long been a subject of discussion and research in the field of AAC. It refers to the apparent relationship existing between a symbol and its meaning (Luftig and Bersani, 1985, p.32). The continuum of iconicity is well established within the field of AAC. This continuum has poles of transparency and opaqueness. In this context, transparency refers to the highly guessable relationship between a symbol and its meaning and opaqueness refers to situations where the relationship between the symbol and its meaning is not understandable even if both are presented.

Translucency is a point between transparency and opaqueness on the iconicity continuum (Luftig and Bersani, 1985, p.32) as translucent symbols' meanings are typically not guessable, but the relationship between the symbol and its meaning become evident when both are presented. Translucency has been found to facilitate symbol learning for both Blissymbols and manual signs (Luftig and Bersani, 1985, p.36) and therefore seems to be an important factor in the learning of visual, non-speech systems (the law of minimal learning). Thus, a large number of icons that are either transparent or translucent are desired so that users can either guess the meanings associated with the icon or they can learn it easily. Translucency has at least two underlying processes: firstly, speculating about possible meanings of an icon and then, after presentation of the referent, understanding the connection, which implies a deep learning activity.

The degree of translucency prevailing for a specific graphic representation or icon is influenced by aspects like the user's language, culture, world knowledge, personal experience, age, gender, etc. These aspects also influence the way in which the icon is perceived and thus the types of associations made with the icon. Considering the many cognitive demands facing AAC-users wishing to use more sophisticated VOCAs, it is an essential part of accountable service delivery to optimise their AAC-systems, in terms of comprehensiveness and ease of learning (laws of minimal learning, minimal energy, and the law of parsimony). It is therefore necessary to determine whether present users attach the same meanings to the different Minspeak™ icons in Unity™ and whether they describe the associated meanings with the same words, phrases and sentences as in the current Unity™ vocabulary. This information could guide interventionists in designing AAC systems engineered to lessen the cognitive demands connected to learning the encoding system optimally (law of minimal learning and minimal energy).

In order for an encoding system, like Minspeak™, to be used effectively, icons need to be either transparent or translucent as the efficient use of codes depends on the user's ability to make functional associations between the icons and their meanings (Bruno and Goehl, 1991, p.70). Iconic encoding depends heavily on a "network of personal associations" (Light et al., 1990, p.196). An investigation into the different types of possible associations is warranted.

2.6 ASSOCIATIONS AND MENTAL REPRESENTATIONS

At any given point in time, the meaning of each icon is influenced by the context in which it is used as well as by the user's ability to associate multiple meanings with it, i.e. association performance (Bruno, 1989, p.89). Association performance is typically influenced by the person's cognitive and language abilities, as well as his prior personal experience (Nelson, 1977, pp.93,95,103; Petry, 1977, pp.69-70). It seems probable that when the user's language, culture and world experience differ from that of the creators, association performance might be compromised (law of minimal learning and minimal energy).

In augmentative communication systems, efforts have centred around enhancing understanding of different symbolic representations by making them more simple and direct (overemphasizing the law of parsimony). A picture, e.g. of an apple, designed to represent the concept "food" is not usually intended to represent other conceptually unrelated meanings

such as "red" or "round". Such other meanings are usually regarded as "noise", something to be avoided (Barry and Baker, 1990, p.4).

The work of the German structuralist E.B. Titchner (1910) on the structure of consciousness is seen as a precursor of modern schema theory. Titchner observed that subjects often committed what he called stimulus error, i.e. when observing objects or events, they reported previous knowledge rather than the attributes of the objects or events themselves. What to Titchner was error to be avoided and an irritating invasion of prior knowledge, is seen by cognitive scientists today as the basic nature of perception and comprehension (West, Farmer and Wolff, 1991, p.5).

A revolution in our understanding of the possibilities for language representation takes place when we begin to treat the "noise" in graphic representation as meaningful information. When we systematically stop disregarding other visual and conceptual material on an icon, a whole new world opens up. This same phenomenon is evident in the following example from Prentke Romich Company:

> *A shoe is not just a shoe. It can have laces. It can be a tennis shoe, a dress shoe, a working shoe. It can be a man's shoe, a woman's shoe, a child's shoe, a baby's shoe. It can be one shoe or a pair of shoes. It can be an old shoe or a new shoe. It can even have a hole in its sole. It can be a leather, rubber of canvas shoe. It can be a brown, black, or red shoe, etc.*
>
> *(Baker et al., 1990).*

The production and manipulation of representations can be viewed as an essential and characteristic human activity. Rosenberg (1981, p.1) postulates that "except for babies and the profoundly brain-damaged, all humans, of whatever time and culture, engage in it, and, insofar as we can now say with any confidence (the verdict on dolphins and the data on Martians not yet having come in), only humans do". Individuals' representations of graphic symbols include representations of both things and states of affairs. Symbolic representation is, paradigmatically, seen as linguistic representation as it enables the individual to gain access to meaningful language units that could be implemented in transmitting information during communicative interaction.

All conventionalised linguistic expressions, including morphemes, words, idioms, phrases, etc., are connected with meaning potentials, which are seen as a person's memory of the previous uses of a particular expression and can be seen as the junction of all the information the person can associate with the expression. The semantic part of this information will

include episodic and semantic knowledge concerning the expression's referent or the different associations with it (Allwood, 1999, p.2). In the case of individuals who have little or no functional speech, these "expressions" can be viewed as output with any AAC system.

If the user makes associations with specific symbols (icons) that are in some way related to the meaning of the message, recall may be easier (Quist and Lloyd, 1997, p.119). West et al. (1991, p.9) pointed out that it is difficult to predict what schemata will be activated and, therefore what meaning will be derived as persons have many schemata and events have many attributes. Knowing what schemata will be activated in a person by attributes of events is a "low-probability prediction" (West et al., 1991, p.9). That is to say, we cannot always know what schemata will be activated and which parts of the event are together partially determining the meaning derived. During human perception schemata are often already active in our minds as we observe an event.

Meanings are "in the head" (Allwood, 1999, p.21). Thus the meaning a person assigns to a certain word or symbol is subjective. Since the cognitive structures in our heads are connected to our senses, directly or indirectly, it follows that meanings are, at least partly, based on our perceptions of the world, i.e. they are perceptually grounded. At this level, people with severe speech and physical disabilities might have a disadvantage, as their experience of the world and their episodic and semantic memory may be influenced by restricted access to the world. Their access is limited due to motor limitations which in turn, restricts their access to the various perceptual experiences to which typical children are exposed. However, Putnam (1988) has opposed this approach by stating that meanings are not merely subjective in nature. He proposed that every word the speaker uses is associated in his mind with a certain mental representation (Putnam, 1988, p.73). He added that two words could only be synonymous when they are associated with the same mental representation by the speakers. The individual's mental representation determines the meaning of the word. Putnam also claimed that these three conditions cannot be simultaneously satisfied as we "cannot individuate concepts and beliefs without reference to the environment" (Putnam, 1988, p.73). Therefore, meanings are subjective, but they also need to be *inter-subjective*, to be meaningful in communicative interactions. Thus, the same meaning should be communal to other individuals. It is essential to see the process of developing meaning as inter-subjective, thus an interaction between communal and subjective meaning.

Establishing meaning is essential in learning. Learning is virtually impossible without perception and very little perception is possible without the relevant schemata in place (West et al., 1991, p.9). Not only do these schemata allow perception, but recall is enhanced when schemata pave the way for comprehension and learning. Perception seems to go awry when a poor match exists between the event and the schema activated at the time.

West et al. (1991, p.9) proposed the following example: "Suppose that you knew nothing about stretching out before and after exercise. Suppose you see a woman pushing at the trunk of a large tree. It would seem a bizarre scene. You might assume that she was attempting to uproot a very large tree with her bare hands. Suppose you next see, sitting on the grass of a park, a man in shorts and canvas shoes apparently trying to tear off his leg". These two events were perceived in terms of the schemata available, which clearly didn't include comprehension of the visual perception in order for learning to take place. When no relevant schemata are in place, the relevance of associations might be compromised due to the impropriety of the referent, e.g. the man trying to tear his leg off, in stead of a jogger stretching. These concept schemata seem to be the "fundamental representation" of knowledge, attached to the individual's attitudes, beliefs and values (West et al., 1991, p.15). How we organise our vocabularies and how we attempt to convey normal language usage are both reliably linked to the categorisation systems we consciously and unconsciously use across our individual language structures. Concepts, which express themselves among other ways through language and metaphor, are based on category systems. The way knowledge is structured and the way vocabulary is categorised and organised on the grounds of meaning and metaphor, might both influence the associations individuals make with certain icons.

Attempts to categorise associational structures implemented by individuals differ significantly as each categoriser employs his or her internalised models about the world and language to establish such categories (Baker et al., 1990). Elder and Goossens (1989) outlined a series of 12 recognition strategies utilised by AAC users and their clinicians with the semantic compaction technique. These strategies relate to associational categories, viz. function, attribute, colour, shape, hierarchical category membership, coordinate category membership, shared substance, associated proximity, visible part, inferred part, homophony and similar appearance. The different types of possible associations will now be examined.

2.6.1 Different types of associations

Various researchers (Nelson, 1977; Pollio, 1964; Petry, 1977; and Palermo, 1971 amongst others) have postulated that there are mainly two general kinds of associations, naming syntagmatic and paradigmatic categories. Syntagmatic associations are responses that differ in grammatical class from the stimulus word and paradigmatic associations are responses that share the same grammatical class as the stimulus word (Bruno and Goehl, 1991, p.71). See Table 2-2 for a short description and examples of syntagmatic and paradigmatic associations.

Table 2-2: Short description of paradigmatic and syntagmatic associations

CATEGORY	DESCRIPTION	EXAMPLES
Paradygmatic	Associations are in the same grammatical class as the stimulus word	table - chair (noun - noun)
Syntagmatic	Associations differ in grammatical class from the stimulus word	eat - cookies (verb - noun)

Further sub-categorization of the two larger classes are specified in the literature. The subcategories describe and specify the subrelation between the stimulus and the response, thereby offer independent categories to define association performance. The subcategories for paradigmatic associations are all classified as nominal (Bruno and Goehl, 1991, p.73,79) including superordinate, subordinate, coordinate, contrast, part and location. The subcategories for syntagmatic associations include functional, perceptual and episodic associations (Bruno and Goehl, 1991, p.71). Table 2-3 is a summary of the subcategories based on the analyses by Bruno and Goehl (1991, p.79).

Table 2-3: Summary of subcategories for paradigmatic and syntagmatic associations (Based on Bruno and Goehl, 1991, p.79)

CATEGORY	DESCRIPTION	EXAMPLE
Functional	Associations describe the stimulus picture or word in terms of some *characteristic and specific* action, activity or use	book – read (noun – associated verb)
Nominal	Associations fall within the same grammatical class as the stimulus (i.e. noun - noun) and imply a specific subrelation to the stimulus picture or word. Associations can further be categorised as superordinate, coordinate, subordinate, part or location	stimulus pic/word: apple superordinate: fruit coordinate: banana subordinate: pie part: core location: fridge
Visual	Associations describe salient characteristics of the stimulus or reflect configurational similarity	(noun - adjective) ball - round, blue, plastic apple - round, red, etc
Auditory	Associations adds to the auditory dimension in terms of rhyming with stimulus, or indicating an associated sound	hammer - "ouch!" ice cream - "yum!" stone - moan
Episodic	Associations depicts a personal experience associated with the stimulus and are usually narrative descriptions in subject-verb-object format; describing an event, a location, an action or a learned behaviour	candle - at Christmas time there's lots of candles (event) hammer - you put in a tool box (location)
Extraneous	Responses that seem unrelated to the stimulus or inappropriate as association	

As there are different independent association categories, these categories could provide a basis for defining association performance and describing the association categories that could

be used to encode messages using icon sequences (Bruno and Goehl, 1991, p.71). The assessment of an individual's skill of association is generally included in assessment protocols to determine whether the individual would be able to use encoding systems that are based on association. Some of these assessment protocols, like those proposed by Elder, Goossens' and Bray (1989) and Glennen (1997) use certain questions to assess the individual's ability to make associations and to obtain information as to the content and types of such associations. The types of associations that could be cued by such questions could include the following (based on Beukelman and Mirenda, 1998, p.208):

- object function associations – e.g. What do you do with it?
- parts of the whole associations – e.g. What obvious parts does it have?
- similar item associations – e.g. What is similar?
- physical properties associations – e.g. How would you describe it in terms of colour, size, shape, texture, temperature, substance, etc.
- category associations – e.g. What group does it belong to?
- rhyming associations – e.g. What sounds the same?
- look-alike associations – e.g. What looks the same?

Similar questions were posed in the What is Minspeak™? book (Van Tatenhove, 1993) and it seems that these questions are a widely used and seemingly reliable method to cue different types of associations.

In order to provide accountable service to AAC users and their families, we need to investigate the types of associations they make with each of the icons used on the Minspeak-based VOCA. This should be done to determine whether the different multiple meanings associated with each icon could easily be learned and recalled with maintenance of the meanings over time. If the latter is not the case, the encoding strategy is not conducive to rate enhancement or effective communication, whereby accountability of intervention is undermined. Therefore the different associations that users make with the icons should be investigated, so that meanings can be added, omitted and adapted for use.

How schemata are formed, relies heavily on meanings derived during the individual's experiences in context. The subsequent words and their meanings employed by the individual therefore reflect the person's context, including amongst other things his culture, ideas, values, attitudes, and belief system (Thipa, 1980, p.1). This means that the context in which

people live (their culture, their ideas about the world, their values and beliefs on which they ground their existence and their attitudes towards different things, people, activities, ideas, disabilities) influences and is reflected by the associations they make and the different meanings they assign to words. It seems clear that culture is an important part of people's acquisition of world knowledge. Similarly, it impacts on how individuals perceive certain graphic representations and the types of associations they make with these graphic representations, which might impact on the ease of learning. Both nonsymbolic and symbolic forms of communication are dependent on the individual's culture (Huer, 1997, p.25). In order to understand the underlying dynamics of a culture it is important to understand the influence of culture on symbol learning.

2.6.2 The impact of culture on symbol learning

Culture is not acquired by any genetic hereditary process (Thipa, 1980, p.15), but it is learned and transmitted from parents to their children and is therefore a social process. Culture is dynamic as it changes with the ever-changing environment and it adapts to that environment or context (Herskovits, 1970, p.653). There seems to be two different schools of thought concerning the definition of culture. The first considers culture to be an inventory of items that separates one specific culture from another; and the other defines culture in terms of ideas. Collins (1975, p.203) defines culture as "that complex whole which includes knowledge, belief, art, morals, law, custom and any other capabilities and habits acquired by man as a member of society". This will also be the working definition when referring to culture in this study.

Light (1988) emphasised that a client's functional skills within his context should be a priority in intervention. Communication can only be functional if it is set within a specific set of cultural rules. Competency in communication is the sum of functionality and adequacy in four interrelated areas: social competence, operational competence, linguistic competence and strategic competence (Light, 1989). These areas should be seen against a cultural frame of reference, as a person's culture impacts on the level of competency required, the preferences of the user and significant others, what behaviours are expected and what is considered to be appropriate (Hetzroni and Harris, 1996, p.55).
A person with disabilities is essentially part of two cultures: those of a person with disability, and the "indigenous culture that the AAC user was born into" (Hetzroni and Harris, 1996,

p.55). These authors postulate that an AAC user is "by default bicultural" and that this phenomenon requires him to learn functionality in at least both these contexts. This might significantly impact how AAC systems are selected and engineered (law of best fit, law of practicality and use). Having said that, how does the "complex whole" of culture affect how people make associations with Minspeak icons?

People in Africa are generally viewed as inhabitants of a Third World continent where poverty, famine, crime, chronic disease, lack of resources and overpopulation are well-known phenomena. Their knowledge, and supposedly the world knowledge of people from other developing countries, may therefore vary from that of the creators of the Minspeak™ approach and Unity™. Even items viewed as fairly universal like a toilet, a house or even a mother, might conjure up different visual images in Africa, e.g. toilet might constitute a one square meter tin hut next to a tree; a house might be made of brick, of tin, of poles, of branches and leaves, or it may be a cave; a mother might be a teenager, a mature woman, a lady with several brass rings around her neck, a person who prepares food, etc. A specific culture is integrated with the different languages spoken by the members of that culture, and their language reflects those aspects that are important or have been important in the past (Lyons, 1976, p.248). Language and its use is a basic characteristic of both human behaviour and culture, as a large part of culture transmission takes place via language (Thipa, 1980, p.1). Whorf's Dissection Theory (the name taken from the opening line of the quotation presented below), summarises the important impact of language on culture and on the way we view the world.

> *"We dissect nature along lines laid down by our native languages. The categories and types that we isolate from the world of phenomena we do not find there because they stare every observer in the face; on the contrary, the world is presented in a kaleidoscopic flux of impressions which has to be organised by our minds - and this means largely by the linguistic systems in our minds. We cut nature up, organise it into concepts, and ascribe significances as we do, largely because we are parties to an agreement to organize it in this way - an agreement that ... is codified in the patterns of our language."*
>
> *Whorf, (1974:213)*

According to the Dissection Theory, the way in which people from different cultures conceptualise the world varies between languages. Language, and therefore words and their meanings, could be seen as reflecting the culture of its speakers and the circumstances or context in which they live (Thipa, 1980, p.1). Culture can further be viewed as being mirrored or indexed by semantic fields. The impact of semantic fields on culture and associations should be investigated.

2.6.3 Semantic fields

A semantic field (or a semantic domain) is a group of words, phrases or concepts closely related in meaning, that share certain semantic features, characteristics or components (Lehrer, 1974, p.1; Thipa, 1980, p.1). A semantic field defines an area of cultural experience that gives meaning to the different included words and concepts, and it can typically be grouped under a general term (Nida, 1975, p.229). The features denoting the particular semantic field's boundaries are defined by the specific features and components that are common to the different words and concepts included in the semantic field. Lehrer (1974, p.10) emphasizes that not all items in a semantic field have equal status and she distinguishes between basic and peripheral words, where the basic words determine the meaning represented in the specific semantic field.

A semantic field is typically composed of a "common conceptual domain" consisting of words that are related regarding either features of similarity or features of contrast (Lehrer, 1974; Kittay, 1987; Grandy, 1987). These attributes include language features like synonymy, subordinates, coordinates, superordinates, antonymy, et cetera. The features denoting the conceptual base of a specific semantic field were also highlighted in the discussion of the different types of associations, with specific reference to nominal associations. Semantic relations within semantic field theory are at least partly made up of word meanings – a phenomenon that was also mentioned in the discussion on associations.

In the literature, there are two basic tendencies: firstly the tendency to restrict the concept of semantic fields to labels belonging to the same syntactic class; and secondly, to include the study of semantically related words belonging to various parts of speech critical. Both these tendencies are in line with this study's theoretical slant, as associations from both the same and different syntactic classes are included, in order to select vocabulary associated with icons that represent all the different parts of speech. Semantic field theory further claims that word meanings can be understood when they are viewed in relation to other words denoting specific features (Lehrer and Kittay,1992, pp.3-4). The following excerpt from Lehrer and Kittay (1992) aims to explain this phenomenon.

> *"Thus to understand the meaning of the verb "to sauté" requires that we understand its contrastive relation to deep fry, broil, boil, and also to affinitive terms like cook and the syntagmatic relations to pan, pot and the many food items one might sauté."*
>
> *Lehrer and Kittay (1992, p.4)*

In order to understand what the meaning of a word is, we need to understand what it is not. This distinction might not be equally obvious for people with different ethniticity. The criteria for words to be included in a semantic field depend upon the specific relationships among words. E.g. green is a subordinate of colour and a coordinate of red and both red and green are part of the semantic field of colour (Lehrer and Kittay, 1992, p.4). This study's discussion of semantic fields will be limited to relationships denoted by:

- superordinates (vehicles = cars, kombi's, vans, trucks, etc.);
- subordinates (different physical forms of the word like *apple pie, apple juice, apple yoghurt, baked apple,* etc.);
- synonyms (words with similar word meanings, but nuance differences like *pretty* and *beautiful* or *jumping* and *leaping*). In defining a semantic field we would typically want to include synonyms of those terms included;
- coordinates (words specifying shared features like *banana, apple, grape, strawberry* and *pineapple* = fruit); and
- parts (parts of a car = *wheels, doors, seats, engine, lights*, etc.).

For each semantic field there should thus be a single general expression that covers all other items (Grandy, 1992, p.109). Yet, when selecting vocabulary to include on a specific individual's VOCA, different words from the same semantic field are included in order to add richness to the language available to the user. Resemblance among words from the same semantic field and even differences among different semantic fields, can add to the memory load inflicted on the user, when expected to remember the different codes of an encoding system. As mentioned earlier, there are various cognitive demands influencing the effectiveness of rate enhancement techniques and the implementation of semantic field theory should be employed to the AAC user's benefit.

As is currently seen in the Unity™ software, groups of words or concepts from the same semantic field are grouped under a certain icon. The icon then serves as the "general term" under which the other words are included. However, the icon is not only the general term, but also the user's aid for retrieval, as the user can associate a certain group of meanings (i.e. a semantic field) with a specific icon, select the icon and via icon prediction select other icons in the icon sequence. For instance, the APPLE-icon represents the food-related semantic field. When the AAC-user intends to communicate about a food-related subject, he selects

the APPLE-icon - setting the boundaries for the meaning of his message. He can now further select which word or phrase within the boundaries of this semantic field he wishes to use, by selecting the next icon in the icon sequence – based on the visual features, characteristics or components seen when viewing the relevant icons. This principle is the underlying basis of the Unity™ software package.

2.6.4 Unity™

Unity™ is a software programme of prestored messages, based on the semantic compaction or Minspeak approach of minimum effort speech and is used on VOCAs manufactured by the Prentke Romich Company. Historically, a variety of Minspeak Application Programs (MAPs) were developed based on the heterogeneity of the AAC user population. These MAPs were designed for specific purposes and populations. Although these MAPs are still available, they are not widely used due to significant differences in the icons used and the way in which these icons were organised (violations of the law of parsimony, law of minimal energy and law of minimal learning). Unity™ has now replaced these MAPs due to the necessity of meeting an AAC user's specific needs as he progresses through different stages of language and cognitive development.

There are different levels of Unity™ available in accordance with different stages of language development, including Unity™ AT (a 32-option version), Unity™ 128 (a version with 128 selection-options) and the newest addition, Unity™ 64 (a 64-option version), that is used with the Vanguard™. A version for a 16-option device like the Chatbox™ is also available commercially (UniChat™). The different versions make use of a closed set of icons that is placed in more or less the same location, in order to facilitate development to more sophisticated VOCAs as communication skill develops – just like normal (or "typical") children develop communication skills and become more sophisticated. Placing icons in the same location aids the development of automaticity - potentially a further advantage in terms of rate enhancement (adheres to the law of parsimony, the law of minimal energy and the law of minimal learning).

However, Unity™ was developed in the United States. Although there are versions available in other countries and languages, like Germany (German), France (French) and Great Britain (British English), none of the existing versions are guaranteed to be applicable for use in the

South African context. No two languages or cultures are so similar that translation can be done directly and that such a translation can be viewed as representing the same ideas and concepts as the original version. The complexity of factors that can impact on the applicability of a specific version of Unity™ in South Africa, makes adaptation of this software a prodigious task.

In the development of a comprehensive AAC system that is based on iconic techniques, the user and interventionist are faced with two options: they can either develop their own set of graphic representations and assign their own list of prestored messages to each representation; or they can make the assumption that there is a common underlying similarity in the associations that are made by different people and use existing programmes, including a range of possible graphic representations and a range of possible associations with these icons. It seems clear that the former is more individualised and therefore more applicable to the specific user, but the skill, time and cost required for the development of such a system, renders it economically not feasible.

The second option includes the development and/or use of a general programme, like Unity™, that is based on common associations to enable users and interventionists to implement certain icons and their associations for communicative purposes. This option, however, is not problem-free, as the programme might need to be adapted for future use in a particular context. Yet, when viewing the intersubjectiveness of meanings, the researcher would suggest making use of a combination of these two options: implementing general icons and vocabulary as a basis for developing a customised AAC system, but adapting these icons and vocabulary items for the individual.

The current study is a preliminary investigation into the applicability of some of the Minspeak™ icons for South African VOCA users, with recognition of the multitude of factors that might influence the results. These factors include amongst others the user's world knowledge, beliefs, values, culture, attitudes, language, gender, age and area of expertise. However, interventionists working with individuals with little or no functional speech in the South African context (and other developing countries) need a culturally congruent set of common icons and associations on which they could base their selections and concomitantly, possibly improve the level of accountability of service delivery. Hence, the aim of the current study is to determine which words tertiary education students use, to describe associations

with selected Minspeak™ icons and to compare these words with the current Unity™ vocabulary. This will be done to provide interventionists and users with a preliminary basis of possible icons and associations that might be common to South Africans.

2.7 SUMMARY

Chapter 2 gave an overview of literature relevant to this study. The use of iconic encoding, and specifically the Minspeak™ approach, was discussed along with other rate enhancement techniques, followed by a discussion of the associations made with graphic symbols (icons) used in this encoding technique and the impact of culture on the use of these icons.