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Stages in the acquisition of phonology: The case of Shona child phonology



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A dissertation submitted to the University of the Witwatersrand in fulfillment of the requirements of the degree of Master of Arts in Linguistics

Supervisor: Prof. Maxwell Kadenge

Declaration

I hereby declare that this dissertation is my original work. It has not been previously submitted, in part or in its entirety, to any institution of higher learning.



Laura Pereira

19/07/2018
Date

Acknowledgments

I would like to thank my supervisor, Prof. Maxwell Kadenge, for all his help and guidance with my study.

Key terms: Optimality Theory; constraints; markedness constraints; faithfulness constraints; input; output; candidates; plosive; fricative; velar; lexicon; morpheme.

Definition of key terms

Optimality Theory: A constraint-based theory.

Constraints: Structural requirements of a language that can either be satisfied or violated by output candidates (Kager, 1999).

Faithfulness Constraints: Required restrictions that preserve some or more of the properties of the input in the output. It requires that certain elements of the output resemble the input (Kager, 1999).

Markedness Constraints: The output form needs to resemble a well formedness or shape that is required in the language (Kager, 1999).

Candidates: Realiszations of the input form.

Input: The original representation of a word in a language before it undergoes any phonological changes (Prince & Smolensky, 1993).

Output: The realisation of the input, which has undergone phonological changes in a language (Prince & Smolensky, 1993).

Plosive: A sound (consonant) that is made with complete constriction of the air flow out of the mouth and then a sudden release, such as [p] or [b] (Longman, 2004).

Fricative: A sound produced by forcing air through a narrow opening either between the lips and teeth, or tongue and teeth, such as [f] or [s] (Longman, 2004).

Velar:	A consonant such as [k] that is produced by putting the back of the tongue close to the soft palate (Longman, 2004).
Lexicon:	Words or phrases in a language that a particular person knows (Longman, 2004).
Morpheme:	The smallest unit of meaning in a language, such as ‘so’ (Longman, 2004).
Table:	Presents information or data
Tableau:	Demonstrates comparison of data

List of Symbols

//	Underlying representation (input)
.	Syllable boundary
[ ]	Surface realisation (output)
-	Morpheme boundary

List of Abbreviations

C	Consonant
V	Vowel
OT	Optimality Theory
GEN	Generator
EVAL	Evaluator
CON	Constraints
Pfx	Prefix

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Chapter 1

Introduction and background

1.1 Introduction

This chapter introduces the study, briefly outlines the structure of the dissertation and explains the topic under investigation; this includes the objectives of the research. This chapter will also give a brief background into the topic of interest, including an introduction to child language acquisition, as well as introduce the method of analysis that will be used to demonstrate the acquisition of Shona child phonology.

1.2 Background to the study

Acquisition is one of the important fields of study within linguistics, as well as within other fields of academic research, such as psychology. One of the most prominent figures to focus on acquisition was Noam Chomsky (Chomsky, 1988). Earlier theories were divided into the rationalist and empiricist schools of thought. Rationalists believed knowledge was innate while empiricists believed it was derived from experience (Harley, 2008). What may be innate about language was highly supported by Noam Chomsky. Chomsky argued that the acquisition of language is guided by a set of innate constraints that are similar across all languages, and it is exposure to the language that sets the constraints (Harley, 2008). Although this may be difficult to prove, this study looked at the steps followed by children learning phonology to demonstrate the theory proposed by Chomsky in order to show the presence of an innate set of constraints (Demuth, 2003; Demuth & Morgan, 1996; Vihman, 1996).

Much of the research done so far has been focused on one or more elements of child language acquisition. One of those domains is phonological acquisition. Some scholars who have looked at acquisition, among others, Chiswanda (1994); Ferguson and Farwell (1975); Jakobson (1941); Lust (2006); Mudzingwa (2001); Rose and Inkelas (2011); Sibanda (2014); Stoel-Gammon and Sosa (2009). The most prominent figure in phonological acquisition is Jakobson (Jakobson, 1941); he proposed a systematic approach to the acquisition of phonology in child language (Vihman,

1996). Some of his claims have been questioned although many other researchers have postulated similar stages of phonological acquisition. These topics are discussed in more detail in the next chapter.

In order to demonstrate these sets of constraints Optimality Theory (hereafter OT) will be used to account for the re-ranking of constraints. OT is in line with the structural linguistic approach, that of Jakobson (1941), as it is concerned with the progression from one stage of development to the next by ranking and re-ranking constraints. However, it takes into account child to child variability that were not accounted for by Jakobson (Lust, 2006; Stoel-Gammon & Sosa, 2009). OT will be discussed in more detail in proceeding chapters.

1.2.1 Introduction to child acquisition

As mentioned above, children follow certain steps or stages when acquiring a certain language. Many of the elements of the stages of acquisition have been looked at in isolation (Demuth, 1995, 2003; Vihman, 1996). This study consolidates the findings from previous studies on the stages of acquisition in order to provide a coherent outline of the stages in the acquisition of syllables and segments in Shona, a Bantu language spoken in Zimbabwe.

When acquiring a language, a child must navigate through an enormous amount of lexical and phonological elements and the relation these have to each other (Ferguson & Farwell, 1975). All this information is presented to the child in large chunks and it is the job of the child to navigate through this and decipher it (Ferguson & Farwell, 1975).

The prosodic structure of English-speaking children demonstrates a tendency to include stressed syllables and final syllables in their early speech productions (Demuth & Morgan, 1996). This is due to the utterances being organised into strong-weak disyllabic feet. Children at the early stages of language development frequently omit certain types of functional morphology, such as prefixes or affixes, as well as unstressed syllables (Demuth & Morgan, 1996). Examples (1) and (2) illustrate the

phonological structure of English at the one-word stage, these words have been divided into syllables by means of a full stop (Demuth & Morgan, 1996 p. 3):

	Child	Adult
1)	[rais.ə]	eraser
2)	[él.fʌn]	elephant

In the utterances produced by the English-speaking children, there is a preference for a strong-weak disyllabic foot. In a more complex case, Dutch-speaking children produce a strong-weak disyllabic form and the weak syllable may either be the medial or final (Demuth & Morgan, 1996, p. 3). This can be seen in (3) and (4):

	Child	Adult	
3)	[‘sik.hʌys]	ziekenhuis	‘hospital’
4)	[‘o:.xɑnt]	olifant	‘elephant’

Dutch children also have a tendency to transform monosyllabic words into a trochaic foot (Demuth & Morgan, 1996). This is achieved by either inserting a vowel between two coda consonants (CVCC – CVCVC), or by adding a vowel to a closed syllable ((C)VC – CVCV), as shown in (5) and (6) below (Demuth & Morgan, 1996, p. 4):

	Child	Adult	
5)	[‘bálə]	bal	‘ball’
6)	[‘omə]	oom	‘uncle’

The early words in Sesotho are also disyllabic, but there is no word-level stress in this language. The productions at the one-word stage in Sesotho are represented as a strong-weak trochaic foot, as seen in the previous English and Dutch examples (Demuth & Morgan, 1996). Even in the Sesotho two-word stage there is a preference for disyllabic outputs, even though both words are part of the same noun phrase. The morpheme boundaries are indicated with a - . As seen in (7) and (8) (Demuth & Morgan, 1996, p. 4).

	Child	Adult	
7)	[ko.lo] [sa.-ne]	se.-ko.lo sa.-ne]	‘that school’
8)	[po.nko] [la.-ne]	le.-pho.qo la.-ne	‘that green corn stalk’

What is clear from the above examples is that there is a preference for a disyllabic word structure, at the early word stage, in the different languages presented (Demuth & Morgan, 1996). The stages shown in example (9) can be set out to show the prosodic structure of syllables and words, which has been said to apply to the acquisition of all languages (Demuth, 1995, p. 2).

(9)

Stage 1 — Core syllables – CV
(No vowel length distinctions)

Stage 2 — Minimal words/Binary Feet
a. Core syllables CVCV
b. Closed syllables CVC
c. Vowel length distinctions CVV

Stage 3 — Prosodic words – larger than a binary foot

Stage 4 — Prosodic words – target form

The development of children’s early words is therefore principled and not just a random process. Although there may be some variation, it is of a certain type and not unique to that child (Demuth, 1995). This is a very brief account of the type of work done on phonological acquisition and the type of stages that children follow. This study delves into the stages of acquisition in greater detail by providing a wider scope of findings from different languages in the world. In addition, this study provides an OT analysis of these stages of acquisition and shows the constraints in a language; in this study, Shona is ranked and re-ranked according to the child’s stage of acquisition.

It is during the first year of life that the repertoire of a child's speech sounds changes dramatically. It is around 2 to 3 months that a child produces vowel like vocalisations and by 6 to 7 months, the emergence of consonant vowel syllables that resemble the adult form appear (Stoel-Gammon & Sosa, 2009). With the onset of CV babbling, otherwise known as canonical babbling, the consonants are often produced in the front of the mouth using the lips or the front teeth and these usually include [m], [b] and [d]. These are often repeated in a syllable, such as [baba] or [dada] 'father'. It is evident that the consonants that dominate the child's repertoire between this time are oral stops, nasals and glides. These babbling sounds serve as the foundations for the production of adult-based words (Stoel-Gammon & Sosa, 2009).

The first-word stage usually ends at around 18 months and this signifies the beginning of the two-word stage. The increase is drastic and by 24 months English-speaking children would have a vocabulary of 250 to 350 words. When looking at the productions made by 2-year-old children, one could do it in two ways; an independent analysis or a relational analysis. An independent analysis summarises the phonetic inventory of the child; this includes the segments, sound classes, and syllables and word structures. A relational analysis is a comparison to the adjacent adult speech, focusing on the similarities and differences (Chiswanda, 1994; Mudzingwa, 2001; Stoel-Gammon & Sosa, 2009). This study focuses on a relational analysis as the adult form provides the input and the child form is the optimal output; in OT terms.

The speech of a 2-year-old English first language (L1) speaker contains basic elements that are present in adult speech. Although the child's phonetic inventory is not yet complete, it already contains stops such as [toe] and [doe], labials and alveolar nasals such as [me] and [no] and glides such as [we] and [you]. At the age of 2, two adjacent consonants will be produced as in [twin] and [milk]. By 36 months, the English phonetic inventory includes nearly all manner and place classes as well as a wider range of syllable and word types (Stoel-Gammon & Sosa, 2009).

It is at around the age of 4 that children's utterances are fully intelligible; what this means is that it is not devoid of errors or represents the adult form, but rather is understood by any adult not familiar with the child. When comparing the utterances

of an adult and a child, there are a number of phonological processes that are undertaken by the child to produce an intelligible utterance (Stoel-Gammon & Sosa, 2009).

Table 1 below demonstrates a number of repair strategies used by English speaking children in order for the constructs to fit into the child's grammar:

Table 1: Phonological Processes (Lust, 2006 p. 158)

Deletion/Omission	**Assimilation**	**Substitution**
Consonant cluster reduction e.g. 'broke' – [bok]	Regressive assimilation e.g. 'doggy' – [goggy]	Gliding: substitution of liquids for [w] or [y] e.g. 'broke' – [bwok]
Final consonant deletion e.g. 'it' – [ɪ-h]	Progressive assimilation e.g. 'kiss' – [gik]	Fronting: substitution of front consonants, [t] or [d], for back, [k] or [g] e.g. 'kitty' – [ditty]
Unstressed syllable deletion e.g. 'banana' – [naenə]	Reduplication e.g. 'stomach' – [tum tum]	Stopping: substitution of fricatives or affricates for stops e.g. 'shoes' – [tuid]
		Voicing: voicing word initial consonants e.g. 'pie' – [bie]
		Devoicing: devoicing final consonants e.g. 'knob' – [nop]

Table 1 demonstrates how children employ certain strategies to tackle certain sounds and syllable structures, as in 'broke' produced as [bok]. The reason for the omission is that there is a complex onset, which has not yet been mastered by the child; hence the complex onset is simplified through consonant deletion. There are a number of strategies that a child could use to repair a marked structure like a complex onset. Firstly, a sound could be deleted from the sequence. Secondly, sounds could be

assimilated to one another (Lust, 2006). This means that a sound is made to become similar in pronunciation. Assimilation can occur on adjacent or non-adjacent sounds, which could cause them to share some or all of the features, either in manner or place of articulation. This is to create consonant harmony, which results in the spreading of one or more feature from one consonant, to another for ease of production. Thirdly, in substitution, a sound is replaced for an opposite sound, front to back or voiceless to voiced (Lust, 2006). This is largely due to the underdeveloped articulation system and children's early speech consists largely of complete closure of the lips or tongue against the palate, resulting in [b], [d], [m] or [n] productions (Lowenstein & Nittrouer, 2008).

All the examples demonstrated above show that there is work that has been done on other languages, but not on Shona. The results are isolated to the researchers' topic and therefore they do not combine with other works to present the findings in a set of stages. This study addresses this issue by applying what has been found in other languages to Shona child phonology. The study of child phonology acquisition is vast with focus being on the structures of phonology or morphosyntax, to name a few (Mudzingwa, 2001; Sibanda, 2014).

As a result of all this research, there have been many theories and claims about the stages that children follow or features that are acquired (Demuth & Morgan, 1996; Lust, 2006; Stoel-Gammon & Sosa, 2009). This study therefore consolidates some of the findings from previous works on the stages of acquisition in order to generalise the stages of acquisition using data from other languages, which is analysed using the OT framework in order to demonstrate the re-ranking of constraints between each stage. It is important to do so, as little work has been looked at regarding the stages of acquisition from an OT framework. The stages that are examined are from the one-word stage to the two-word stage followed by the third stage, telegraphic stage (O'Grady & Cho, 2001). In doing so, the research findings are then compared to Shona child phonology. The reason for the age selection is that it provides an insight into the beginning stages of Shona acquisition. This provides the starting point for further research. Variation between stages is accounted for by using the OT notion of

factorial typology, which contends that linguistic variation is a result of different rankings of the same set of constraints (Kager, 1999; Prince & Smolensky, 1993).

The research done by Mudzingwa (2001), Chiswanda (1994) and Sibanda (2014) provides Shona data for the current study, a total of 180 words were selected; 60 from each study, see appendix 1, 2 and 3. These studies were done in one of two ways, naturalistic or elicitation, and focused on one aspect of phonological development. Some of the features that have been examined include prosodic structure, words and sounds (Demuth & Morgan, 1996; Ferguson & Farwell, 1975).What has not yet been looked at in detail is the differences between each stage of acquisition, the focus has been on what is acquired at each stage and not what happens from each stage to the next as the child progresses. The current study demonstrates the changes between each stage, using OT in order to demonstrate that the progression to each stage occurs as a result of the re-ranking of constraints.

1.3 Objectives of the study

The objectives of this study are as follows:

(i) Identifying and characterising the stages of phonological acquisition regarding syllables and segments in general;

(ii) Account for the stages of acquisition of Shona child phonology, using OT.

1.4 Structure of the dissertation

This dissertation is divided into five chapters and an additional appendices division. Chapter 1 gives a brief introduction to the study, the research objectives as well as the aims of the study. This chapter also includes examples from the stages of phonological acquisition.

Chapter 2 presents a review of previous studies on the topic under investigation, acquisition. It identifies the gaps in knowledge, which this study addresses. An in-depth analysis on stages of acquisition will also be presented.

Chapter 3 discusses the method of data analysis, as well as the archival data used in the current study.

Chapter 4 provides a detailed discussion that demonstrates the constraint ranking employed by Shona children during the stages of phonological development. The formal analysis in this chapter is done using OT.

Chapter 5 concludes the study and makes recommendations on areas that require further investigation. The conclusion summarises the main objectives and findings of the study.

1.5 Summary

This chapter demonstrated that there are steps that children follow when acquiring a language. While these may seem unique to the child it has been noted that the utterances produced are not unique to any one child but rather shows a similar production pattern, with some child-to-child variability. Prominent figures in acquisition such as Jakobson and Chomsky stated that a set of innate principles were present (Chomsky, 1988; Jakobson, 1941). While hard to prove research done thus far has shown similar patterns in children from different linguistic communities, an example presented in the current chapter showed a preference for disyllabic forms in both English and Sesotho. The succeeding chapter presents a review of previous studies and research related to the broader topic under investigation; acquisition. The chapter also provides a more detailed account of acquisition.

Chapter 2

An Overview of Child Language Acquisition

2.1 Introduction

The previous chapter discussed the area under investigation, problem statement, objectives and justifications for the study. This chapter presents a review of previous studies and theories on acquisition in general. These studies provide useful background and insights into language acquisition. This chapter also provides a description of the method of analysis, OT. The previous chapter presented works or studies regarding the broader topic of acquisition. The current chapter also narrows in on the stages of acquisition. These stages identified demonstrate the changes that occur between each stage of acquisition. The purpose of the findings of this study is to demonstrate a re-ranking of constraints or rules that all children exhibit.

2.2 An account of the Theories of Acquisition

The study of acquisition has long been a topic of discussion in many fields of research. Given the speed at which children acquire their native language, the debate on how they are able to learn to speak has fascinated researchers for decades. One of the most prominent figures is Noam Chomsky (Chomsky, 1988). He proposed that the very capacity for language must be built into the brain that matures, as the child gets older. This theory was known as nativism and Chomsky defined it as the theory of Universal Grammar. This version of the theory states that there is innateness to language. A specific part of the brain is dedicated to the special purpose of a language learning device (Bates, 2003).

Another theory put forward examining child language acquisition was empiricism (Bates, 2003). The main assumption in this theory is that language originates in the environment. Language is taken in through the senses from the environment and the stimulus promotes a response. Language is seen as a skill, no different from any other behaviour, that is learned over time (Bates, 2003; Bohannon & Bonvillian, 2009).

Chomsky (1988) strongly disagreed with this theory. He argued that there is a component in the brain devoted to language learning, known as the language faculty. The initial state of this faculty is similar across all humans, with the exception of those with serious pathology. The theory accounting for this initial state is known as Universal Grammar (UG) (Chomsky, 1988). Universal grammar contains the grammatical rules and categories common to all world languages. As the child develops, these parameters or rules become fixed in a certain way, either for French or English, depending on the native language of the child's home (Bohannon & Bonvillian, 2009).

2.3 An account of Phonological Acquisition

The focus of this study is on the phonological aspect of acquisition. One of the founding fathers of the study of phonological development was Roman Jakobson (Jakobson, 1941); his work is deeply grounded in the structuralist framework. He proclaimed that there were grammatical rules and laws that governed spoken language acquisition (Stoel-Gammon & Sosa, 2009). Jakobson (1941) observed the first words as the onset of linguistic capabilities and regarded babbling as 'wild sounds' and children were capable of producing an infinite number of sounds that were unrelated to any linguistic knowledge (Jakobson, 1941). From the first words it was proposed that there is a universal path of development, which was based on a finite set of distinctive features that are applicable to all possible phonemes in all the languages of the world (Jakobson, 1941).

Many of Jakobson's claims were criticised and this paved the way for new research to take place. One of the biggest criticisms that were made about Jakobson's work was that there was no recognition for child-to-child variability and the dismissal of babbling as a precursor for language (Stoel-Gammon & Sosa, 2009). As literature has demonstrated, babbling is the onset of speech. When children do not babble or cannot, there is a delay in speech development. His work still remains vital for the work on language pathology and the treatment of phonological disorders (Stoel-Gammon & Sosa, 2009). His study provides insight into the beginning stages of acquisition. The current study looks at the stages proposed, following the work done by Jakobson.

Without prompting, children will begin to utter their first words by the end of their first year (Peperkamp, 2003). By the age of three, children have a sizable lexicon and have mastered the important characteristics of the grammar of their language (Peperkamp, 2003). During the first year, the infant's perception of the sound structures of their native language are shaped by the phonological properties (Peperkamp, 2003). Children will begin with identifying the rhythmic and prosodic aspects of an utterance in their language as a whole before focusing on smaller units. The vowel and consonant inventory is then acquired and children will start to segment the words and then acquire word level properties, such as phonotactics (Peperkamp, 2003).

The core phonological knowledge across all speakers of all human languages are assumed to be innate or within the framework of generative grammar. It has been proposed that the segmental categories that infants learn are governed by positional variants (Peperkamp, 2003). The segmental and prosodic context of the segments governs the acquisition rather than the phonemes or phones and initiation of this is rapid. Sound categories are said to be acquired bottom-up through statistical learning measures (Peperkamp, 2003). Mastering the categories relies on two mechanisms of feedback. The first being external feedback, this is provided by a perception-production loop between the infant and the speaker within their environment. The second mechanism is internal phonological feedback, which is provided by the infant's lexicon (Peperkamp, 2003). It is known that infants will discriminate against segmental contrasts whether they are used in their native language or not. It is at the end of the first year that they have difficulties discriminating non-native contrasts, just like adults (Peperkamp, 2003).

Previous research done on early word learning has suggested that infants will begin with producing words with little phonological detail (Peperkamp, 2003). Infants show better recognition of native words when they are produced correctly, and they are already sensitive to the phonological features of words they already know. Segments are not autonomous but one part of a language (Peperkamp, 2003). They are said to have three main dimensions: place of articulation, manner of articulation and voicing. Motor theory of speech perception suggests that humans have innate knowledge of

the articulatory properties of sounds (Peperkamp, 2003). In a study conducted on infants, nine month old children's results showed sensitivity to the manner of articulation of word-initial consonants. When presented with two-word lists, listening preference was given towards the list where the initial consonants of the words had the same manner of articulation. The conclusion made was that infants are sensitive to basic articulatory and/or acoustic properties of segments (Peperkamp, 2003).

In order to map underlying representations onto surface representations, all languages have specific phonological rules and alterations that are permitted. The underlying form is the abstract form of a word or morpheme and is realised in different representations to produce the surface form (Peperkamp, 2003). The concept of underlying forms is central to generative grammar. As infants progress through language acquisition they will build onto these underlying forms by mapping minimal features and language specific phonological representations (Peperkamp, 2003).

In order for segments to be combined into words and syllables, infants must master the language specific phonotactic constraints. These constraints are generalisations of the lexicon and are not a result of phonological rules and alterations. Examples seen in English are the prohibition of syllable-final [h] and word initial [ŋ]. Infants can already segment speech into clauses at seven months. Evidence suggests that infants acquire their language specific phonotactic constraints at around nine months as well as the ability to segment speech into phrases and words (Peperkamp, 2003).

Emergent Phonology is a more recent hypothesis within phonological theory. The hypothesis suggests that certain units of speech emerge during the course of acquisition rather than being innate, which is the Universal Grammar school of thought (van de Weijer, 2017). Elements such as distinctive features, segments and words feet are thought to develop through the stages of acquisition through usage and practice. The advantages of this approach to language acquisition not only explains how linguistic elements are acquired, rather than being part of an innate structure of the child, but also bridges the gap or divide between theoretical phonology and usage-based linguistics (van de Weijer, 2017). The view is that the constraints are part of UG and the question of whether they may be acquired rather than innate is not usually

the focus of study. Using language data, it may be possible to show that the constraints are in fact acquirable. “In my view, however, the constraints can quite easily be shown to be acquirable on the basis of language data alone, obviating the need to postulate their presence in UG” (van de Weijer, 2017 p.154). Children acquiring their first language go through a long period of acquisition in order to become fully competent, but this journey through acquisition is full of variation and errors (van de Weijer, 2017). These errors are not merely random, but rather are a set of constraint re-rankings that are made by children in order for the language to fit into the stage of acquisition. The first question that needs to be answered is, why do children make these errors? Two approaches seek to answer this question, the maturational approach and the linguistic or grammatical approach (van de Weijer, 2017).

The maturational approach states that children are not ready anatomically or cognitively to process or produce the sounds or patterns in adult language (van de Weijer, 2017). As the development is globally similar, the pattern of development will also then be similar. The linguistic or grammatical approach states that language acquisition is comparable across all languages due to the shared set of universal constraints (van de Weijer, 2017).

The topic of van de Weijer (2017) was to demonstrate that the concepts in acquisition are not necessarily universal. To show this, the focus was on the realisation of consonant clusters in English child language (van de Weijer, 2017). At the age of 2.5 years a child will produce ‘clean’ as [kin] or ‘play’ as [b̥ei]. These patterns of speech are typical of this age when acquiring English. The consonant clusters [kl] and [pl] present in adult speech are simplified by leaving out one or more of the consonants within the consonant cluster (van de Weijer, 2017). This process is demonstrated in table 1 in the preceding chapter (Lust, 2006 p. 158). The question raised here then, do English child and adult speakers have different grammars, as there are consonant clusters present in one group of speakers and not in the other. How child speech becomes adult speech has become an obvious object of research. This is most apparent in OT, where grammars are characterised in terms of constraints and not the

transformations or rules seen in generative approaches (Kager, 1999; van de Weijer, 2017).

The premise of OT is that children all start with a repertoire of constraints, which are two types, markedness and faithfulness (van de Weijer, 2017). Markedness constraints favour the simpler structures and faithfulness constraints prohibit any change to the underlying form, either by deletion, insertion or segmental change (van de Weijer, 2017). OT also hypothesises an initial state of language, which is the initial setting of the constraint hierarchy; this is present at or before birth and all children start from the same point. The content of the constraint set and the initial ranking, or non-ranking, of the constraints are then provided by universal grammar and do not need to be acquired (Kager, 1999; Prince & Smolensky, 1993; van de Weijer, 2017). All children will then start with all markedness constraints being high ranked and their first productions will be unmarked when compared to the adult form. Stating that constraints are universal or innate may not be the necessary assumption (Kager, 1999; Prince & Smolensky, 1993; van de Weijer, 2017).

As van de Weijer (2017) demonstrates, the frequency of use can determine the constraint mastery. In the case of Mandarin Chinese children learning English as a second language, there are no consonant clusters present in Chinese unlike English (van de Weijer, 2017). The child will not learn a constraint against the use of consonant clusters but rather it is not used in Chinese so therefore they will not master it due to the lack of frequency. The first language (L1) patterns will interfere with the learning (van de Weijer, 2017).

Ferguson and Farwell (1975) focused on language development of children in terms of two characteristics; firstly, words and secondly, word initial consonants. This research, like many others, stated that the child is faced with huge volumes of lexical and phonological elements and must navigate the relation between these elements as well as the grammar of that language (Ferguson & Farwell, 1975). A child must learn when and how to use language in relation to their needs and norms within a community. All this information does not simply confront the child in small units, but

rather as one enormous batch, which needs to be sorted by the child (Ferguson & Farwell, 1975).

The data presented in Ferguson and Farwell (1975) was part of a larger longitudinal study on the development of consonants in first language learning. Seven monolingual English-speaking children were selected between the ages of 11 months and 1 year and 2 months for the larger study and three were the focus of this paper. This study defines how children navigate through these large elements of language acquisition by exploring constraints that children re-rank in order to progress to full linguistic mastery (Ferguson & Farwell, 1975).

Ferguson and Farwell (1975) found that all three of the children possessed labial and alveolar stops as their first sounds and later included nasals and glides in their consonant inventory. The last of the sounds to appear were fricatives. Velar consonants were also only present in later development. This is largely due to the physiological and motor factors, such as shorter palate and control of tongue articulation. The result is an articulation that extends too far forward, into the coronal area, resulting in a fronted velar release (Ferguson & Farwell, 1975; Rose & Inkelas, 2011).

A big similarity between all three of the children was that they all preferred voiced labial and alveolar stops but voiceless velars. One point that was made in this research was that there was no exact agreement on order among these children (Ferguson & Farwell, 1975). This is one of the criticisms mentioned about Jacobson's theory, although he proposed a set of universal steps, not all children follow the same path. These, and many other studies, show that there is a gradual development of phonological awareness. Children possess the ability to deal with phonological elements in order to realise their phonological awareness (Ferguson & Farwell, 1975).

Rose and Inkelas (1975) not only looked at phonological patterns in acquisition, but how these findings may be interpreted. The general assumption made is that the phonological abilities of a child gradually develop from an impoverished form to an interpretable form from the ambient source (Ferguson & Farwell, 1975; Jakobson,

1941; Rose & Inkelas, 2011). In order to examine this statement, Rose and Inkelas (1975) first looked at segmental patterns that occur in child speech. Examples of these patterns include the preference for devoiced or voiced sounds as well as velar fronting, to name a few. Velar fronting occurs when target velars [k], [g] are fronted to coronals [t], [d]. This can be attributed to the child's inability to lexically represent or correctly articulate target velars (Rose & Inkelas, 2011). These segmental patterns are language dependent and are not isolated to one language in their study (Rose & Inkelas, 2011).

Another aspect of child speech examined is prosodic patterns; such patterns include syllable structure, word shape or the location of stress or tone. Evidence for prosodic pattern discrepancies include infant speech perception (Rose & Inkelas, 2011). English learning children are inclined to associate the stressed syllables with word onsets initially in acquisition. Examples that demonstrate this truncation include 'guitar' being reduced to [tar] and 'gazelle' to [zelle]. These realisations may be the result of a speech segmentation error that yields the incorrect lexical representation rather than being the product of grammatical rule restrictions of the prosodic shape of the phonological productions (Rose & Inkelas, 2011).

The central questions or issues regarding phonological acquisition are centered on the representational abstraction that is required to model children's grammar. These issues emerge due to the lack of unanimity regarding the phonetic and phonological level at which children operate from acquisition to the developmental period (Rose & Inkelas, 2011).

What seems clear from their study is that adult phonological systems include a multitude of simultaneous levels of representation; children possess similar levels and make generalisations about these representational units, depending on the evidence to which they are exposed, from the ambient language. This kind of abstraction also presents some implications as it assumes that a set of universal primitives exists, this is known as the Continuity Hypothesis (Rose & Inkelas, 2011). This notion is deeply rooted in the generative framework and postulates that the child's grammar starts with the same primitives that the adult grammar ends up with. Each stage in phonological

development is assumed to be harmonious with the same set of principles that regulate adult systems (Rose & Inkelas, 2011). This school of thought has been disproved in one facet or another; it has been revealed that child phonology requires rules or constraints that govern their phonology that is not motivated by the adult phonological system (Rose & Inkelas, 2011). The current study demonstrates these rules or constraints used by Shona children during the acquisition of phonology.

2.4 Shona Acquisition and archival data

Little work has been done on the acquisition of Shona. Chiswanda (1994), Sibanda (1994) and Mudzingwa (2001) are three studies that have systematically looked at children acquiring Shona (Chiswanda, 1994; Mudzingwa, 2001; Sibanda, 2014).

Chiswanda (1994) stated that most of the studies done on language acquisition focused mainly on English and the findings were generalised for all languages. Chiswanda was interested in whether there was a difference in the language structure of Shona and English that had not yet been looked at. Chiswanda (1994) carried out the study by following four children between the ages of 12 and 25 months who lived in Harare. All utterances were recorded in a naturalistic setting and a speech diary was kept for each child during this time. The reason for this age bracket was that by the age of 12 months, utterances were audible and understandable (Chiswanda, 1994).

The study was conducted over several months through observational methodology. Chiswanda (1994) observed that the one-word utterances did not always refer to the same kinds of concepts that adults would usually think about or would choose to express. These may be sequences that have been learned from a sibling or caregiver using baby talk. Some examples seen were [pipi] for a ‘car’ by referring to the sound it makes or [tate] for ‘sleep’ (Chiswanda, 1994). Most of the examples given are disyllabic, which means that the preference for disyllabicity is ranked highly at this stage of development. Chiswanda noted that this was particularly noticeable with each of the children in the study during the period of 12 to 16 months. What she proclaims is that early utterances need to be examined in terms of the number of syllables, rather than how many words are in an utterance (Chiswanda, 1994).

During the period of study, it was noted that the children acquired a few semantic fields such as words referring to a particular group or subject. For example, the word [ima] was used to refer to 'drink' or 'water' or 'milk' and was also used as the verb for wanting to drink (Chiswanda, 1994). In this case, there were many overgeneralisations of this field, such as [mama] referring to all women or [dhedhi] referring the men in the child's life. This will start to fade during 17 and 19 months and typically [mama] will disappear first. At this stage, there is the emergence of action words that are used for demanding. [po] or [pe] would be used for 'ndipewo' for the action of 'give me' and [inde] or [nde] will be used for 'handei' for the action of 'let's go'. In the period of 12 to 14 months, these are seldom used. There are also no modifiers for either nouns or verbs used during this period for any of the children in the study (Chiswanda, 1994).

The next aspect that Chiswanda (1994) looked at was sounds. What she noted in her study was that there were a lot of explosives in Shona. At 12 months, for example, [tadha] took the place of [sadza], a staple food of Zimbabwe, in the speech of all the children (Chiswanda, 1994). Fricatives and affricates are not articulated but rather replaced by the stops [t] and [d]. This is the same process seen in English, as seen in [tuid] for 'shoes' (Lust, 2006).

Moving onto the syllables of children at the age of 12 months, typically, the initial syllable is almost always deleted and, in some of the cases, the consonant or consonants at the beginning of the first syllable is also deleted (Chiswanda, 1994). In English, on the other hand, it is usual the final consonant that is deleted, seen in [ɪ-h] for 'it' (Lust, 2006).

One of the major findings by Chiswanda (1994) was that demonstratives are acquired very early, previously thought to have been acquired later. The passives appear in Shona at around 18 months, which is much earlier than children acquiring English (Chiswanda, 1994; Kadenge & Sibanda, 2011).

Chiswanda (1994) concludes that in order to discover the similarities between the number of syllables within an utterance in different languages, one needs to look at

the number of syllables and not the number of words. It was also found in her research that there is a milestone between using two and three syllable utterances (Chiswanda, 1994). “Interestingly, in searching the literature on the acquisition of English, the data suggests that there is a milestone between using 2 and 3 syllable utterances, just as there seems to be for Shona” (Chiswanda, 1994 p.18).

The child utterances collected by Chiswanda provide some of the data for the current study and the differences between the stages in Shona acquisition will be accounted for using OT. This study demonstrates the ranking and re-ranking of constraints on segmental and syllable structures made by Shona children.

Sibanda (2014) focused on the constraints on the development of the inflectional morphemes in the acquisition of nouns and verbs in child Shona. The age range in the study was two years to three years and two months (Sibanda, 2014). The findings indicate that noun and verb inflectional morphemes are omitted while the lexical morphemes are retained in Shona child utterances. The noun and verb inflectional morphemes were also produced as reduced syllables, the consonants were dropped while the vowels retained. The notion of constraint ranking to back the findings was supported by the fish phenomenon (Sibanda, 2014). Berko and Brown (1960) first reinforced this theory in language acquisition in a study centered on word association and the acquisition of grammar (Brown & Berko, 1960). The phenomenon states that children’s comprehension precedes production. The constraints identified were two types, word structure and articulation constraints. The word structure constraints yielded disyllabic outputs as the inflectional morpheme was dropped, [ø-woko] for [ruoko] ‘hand’ (Sibanda, 2014). The dropping of the inflectional morpheme usually occurred when the target words were trisyllabic or quadrisyllabic. Articulation constraints, on the other hand, yielded simpler outputs than the target language, for instance, vowels are simpler to articulate than consonants. The children substituted the complex consonantal segment with a simpler one for the ease of production, [piʃi] for [fiʃi] meaning ‘fish’ (Sibanda, 2014).

The current study uses some of the data collected by Sibanda (2014) in order to have an expanded collection of Shona data to demonstrate the stages of acquisition in Shona child phonology and relevant constraint rankings for each of the stages.

Mudzingwa (2001) used a parental diary and audio recordings to document his daughter's phonological structures over two years. The study established three phases, and in each phase, the adult form was adjusted in order for the child to achieve the desired pattern (Mudzingwa, 2001). The development of the phonological structures of the child come as a result of overcoming or mastering each stage and the relaxing of the child's template of phonology. The results of the study showed that the child begins with the word as the basic phonological unit and gradually shifts to the syllable (Kadenge & Sibanda, 2011; Mudzingwa, 2001).

Mudzingwa (2001) examined the phonological structures in early Shona words. The focus was on the syllables and segments produced by his Shona-speaking daughter and these productions were compared to the adult form. The study demonstrated that specific syllable sizes and phonological characteristics of words are seen at different stages of phonological acquisition (Mudzingwa, 2001). The study identified that the majority of the literature focused on the acquisition of English phonology and the lack of research done on the phonology of Shona children (Chiswanda, 1994; Mudzingwa, 2001).

The study thus focused on the gradual phonological development of a child acquiring Shona as L1; the subject of study was the researcher's daughter from age one year and three months to three years. The specific focus of the study was the development of the segmental structure of her words (Mudzingwa, 2001). Mudzingwa (2001) identified three phases of development, the first being the [muna (there is nothing) - bebe (carry me on your back)] stage. The age bracket for this phase was 1; 3 to 1; 8. This stage can be described as the typical pattern of child productions, as the syllables were phonetically and phonologically simple. She produced CVCV syllable structures, [sisi] produced as [titi] for 'sister' (Mudzingwa, 2001). The similar process occurring is the replacement of the fricatives for stops, as identified in English phonology as well (Lust, 2006).

The second phase of development identified by Mudzingwa (2001) was the [majiguju – θ e θ i] phase, this phase lasted six months and its inception was marked by a rapid increase in the size of Caroline's vocabulary. This stage occurred between 1; 9 and 2; 3. There was an increase in the number of syllables per word (Mudzingwa, 2001). The word length was now four syllables, up from two. This can be seen in [babakuju] for [babamukuru], 'uncle'. There was also an increase in the variety of consonants seen in the words, which was a direct result of the growth of her consonant inventory; dental fricatives [θ] and [ð] and velar plosives [k] and [g] emerged in this stage.

The third and final stage identified by Mudzingwa (2001) is the [ndateŋgega-nditʃ agireji] phase (Mudzingwa, 2001). This stage signified the emergence of six syllables instead of four, as well as the replacement of complex consonant onsets with less complicated consonant onsets. The constraints or rules that governed her phonology became less apparent and the outputs resembled the adult models more closely (Mudzingwa, 2001).

As her consonant inventory expanded there were more complex consonants functioning as syllable onsets, [ŋgwaraji] produced as [ŋgaraji]. Although phonologically 'ŋgw' is a simple syllable onset, phonetically it requires two articulatory manners, which were constrained in the previous stages. Caroline had to overcome the complexity of two articulatory manners in the final stage of development (Mudzingwa, 2001).

The current study builds on the work done by Mudzingwa by analysing the phases identified from an OT framework to show the re-ranking of constraints in Shona child phonology. The data collected by Mudzingwa provide some of the Shona child data for the current study.

2.5 Bantu language acquisition

Tone is another construct in language acquisition, particularly in Bantu languages; it is used in many African languages in order to indicate the lexical or grammatical distinction in speech (Alcock & Alibhai, 2013). Many languages in sub-Saharan

Africa are tone languages and much research has been done on the various aspects of tone. This research from African languages provides clarity on the acquisition of tone.

In a study conducted on Yoruba, a Nigerian language with lexical tone, the perception of tone was examined. The research looked at the head turn preference of infants between the ages of 6-8 months who were growing up in London (Alcock & Alibhai, 2013). These infants were either exposed, or not exposed, to Yoruba from their parents. It was discovered that the infants hearing Yoruba, where there was pitch change to indicate lexical meaning, paid more attention than the infants only hearing English. In Ghana, children learning Ga are able to provide the tonal changes in an utterance before they have mastered consonants and vowels (Alcock & Alibhai, 2013).

Tonal pattern productions are also seen before segmental and morphemic patterns in Chichewa, spoken in Malawi. Elements where contextual uses for tone are required have been shown to be problematic during early acquisition. Correct use of tone during grammatical construction is acquired later in acquisition. It is clear from the research on tone acquisition that context dependent utterances are more difficult than non-context dependent utterances in early acquisition, with frequency and consistency playing a role (Alcock & Alibhai, 2013).

Click consonants are largely found in Southern and Eastern African languages but few studies have been conducted on native speakers. Research has examined the perception of non-native sounds outside the region (Alcock & Alibhai, 2013). An example of such research found that English adults and children exposed to clicks were able to identify Zulu clicks, but the adults were unable to distinguish non-native non-click sounds. In languages containing clicks, it has been found that these are later acquired, compared to the other native consonants (Alcock & Alibhai, 2013).

As well as clicks and tones, other less usual aspects of phonology have been the focus of studies on sub-Saharan African languages. In order to test the theory that common phonemes are acquired earlier, and rare phonemes are acquired later, a study examined a group of phonemes found in a few West African languages. The

acquisition of these more difficult phonemes depended on the difficulty of articulation as well as their rarity (Alcock & Alibhai, 2013).

The accuracy of segmental productions in the region of sub-Saharan Africa have been shown to be high due to the simple syllabic structures, compared to European languages. Even with simple syllabic structures, there are some segments that are more commonly replaced for simple ones, for example a trilled [r] will be replaced with a non-trilled consonant (Alcock & Alibhai, 2013). Consonant harmony has also been observed whereby consonants are changed in order for more consonants in the word to be articulated at the same place. Complex onsets in syllables are sometimes deleted. These processes are present at the stage where children cannot articulate all phonemes correctly (Alcock & Alibhai, 2013).

In Bantu languages, unlike English, there are noun classes that also need to be acquired. The acquisition of noun class prefixes in Bantu languages has been said to be a progression through a three-stage developmental path. Evidence suggests that the noun prefix is acquired as part of the whole noun and not as an individual segment (Tsonope, 1993).

The first stage in the development of the noun class prefixes begins with the nominal forms that mostly contain the last two syllables of the nouns used by adults and they lack the prefix. During the second stage, a vowel is placed before the noun stem from the previous stage. The third and final stage sees the emergence of the noun forms that are identical to the nouns produced by adults (Tsonope, 1993).

Table 2 formalises the stages of noun class acquisition in Bantu languages,

Table 2: Bantu noun class stages of acquisition (Tsonope, 1993 p. 111)

	Child Form	**Adult Form**
Stage I (stem without prefix)	-togó	mo-togó
Stage II (place-holder vowel)	e-togó	3pfx-stem
Stage III (prefix plus stem)	mo-togó	“soft porridge”

Explanations as to why noun stems are acquired before prefixes state that the stems are content words and the prefixes are merely grammatical forms. This is however, problematic in a number of ways. Prefixes can change the meaning of a word when affixed to noun stems (Tsonope, 1993). This then suggests that prefixes are not grammatical forms but rather can change the meaning of the stem. By using the labels of "stem" and "prefix" this suggests that a child is aware of these structures. If a child were aware of this then the question of why they delete the prefix if they are aware would be raised (Tsonope, 1993). If distinguishing the content were the case, then it would not explain why monosyllabic stems are acquired together with the prefix.

Tsonope (1993) interprets the processes that occur during the three stages differently. During the first stage, the noun stems appearing without the prefix is merely the children forming their own template-based phonology of the language (Tsonope, 1993). The second stage, which comprises a placeholder vowel, is an expansion on the template-based forms. As the child progresses, they encounter more noun forms that do not fit into the template-based canonical shape. The child begins to expand the disyllabic template with "e" vowel. The emergence of this vowel may indicate a lack of performance rather than a lack of competence (Tsonope, 1993).

The study of Bantu language acquisition is important for a number of reasons. With the vast number of Bantu languages spoken and each having a slightly different linguistic structure, the research provides a greater understanding of the nature of language development (Demuth & others, 2007). Sesotho is one of the many Bantu languages spoken and due to its simple syllable structure, most of the consonants and vowels are acquired by the age of two.

Difficulty with labial glides and simplification of affricates and clicks persist until the age of three. Sesotho speaking children do not appear to have difficulty with place of articulation and voicing (Demuth & others, 2007). Like other Bantu languages, Sesotho has a vast noun class agreement system and many of the monosyllabic morphemes are missing or reduced at the age of two but by age three they are well formed. Most of the simple consonants have been acquired by the age of two and

these include syllabic nasals and voicing distinctions on labial and alveolar stops (Demuth & others, 2007).

In many Bantu languages, nouns are assigned to classes. Each of these classes has a prefix associated with it and has its own set of agreement morphemes. These noun classes have been the topic of multiple academic works (Demuth & Morgan, 1996; Kadenge & Sibanda, 2011; Tsonope, 1993). These works report that children acquiring Bantu languages have grasped noun classes and their agreement markers before the age of three. Studies on the acquisition of Bantu morphology report on similar findings. Firstly, singular and plural noun class prefixes are produced as separate morphemes early in acquisition (Kadenge & Sibanda, 2011). Secondly, there are no instances where plural morphemes are added to singular stems nor are there noun class prefixes added incorrectly to nouns that do not have prefixes (Kadenge & Sibanda, 2011).

Similar to the findings of Tsonope (1993), other studies on Bantu acquisition report parallel findings concerning the acquisition of noun class prefixes and the overlap of each stage during the ages of 2-3 (Demuth, 2003; Kadenge & Sibanda, 2011; Tsonope, 1993):

- No prefixes (full or partial noun stems)
- 'Shadow' vowel and nasal prefixes
- Full and phonologically appropriate noun class prefixes

Kadenge and Sibanda (2011) sought to examine the noun class prefixes of Shona by looking at the shape of the noun class prefixes of 2-3 year old children speaking Shona as their mother tongue. The data were collected from three children through observational/naturalistic settings. The earliest stage in the development of Shona noun class prefixes is characterised by the omission of noun class prefixes (Kadenge & Sibanda, 2011). This is due to the child not yet having acquired them. In this first stage, children's words are made up of lexical morphemes only. These lexical morphemes are seen as whole words and they do not have information regarding number or class, which is signified by the omitted class prefix. For example, the /mu-/

prefix in Shona is a class 3 signifier, when producing [mu-riwo] (vegetables), children will perceive [–riwo] as a whole word (Kadenge & Sibanda, 2011).

Children in category 1 produced no noun classes. Children at this stage of acquisition, category 2, will produce onsetless vowels rather than the syllable shape required in Shona. Although at this stage, children have not yet fully acquired the full syllabic structures of adult words, they have acquired a rule to form whole words by adding grammatical markers (Kadenge & Sibanda, 2011). The onset consonant of the prefix, as well as the initial consonant of the lexical morpheme is omitted, leaving an onsetless vowel functioning as the prefix. The dropping of the consonant eases the articulation of a word. The final stage of class prefixes is characterised by full noun class prefix production. Children in this category produce word that are phonologically similar to adult words and contain the appropriate prefixes (Kadenge & Sibanda, 2011).

2.6 Introduction to Optimality Theory

Optimality theory is essential in this study in order to provide systematic representation of a child's progression through acquisition. OT was introduced by Prince and Smolensky (1993) and is the leading theoretical paradigm in phonology. This theory is constraint based and contains a set of constraints that are violable. These constraints demonstrate a universal property for all languages (Archangeli, 1997). The goal of this theory is to demonstrate that core grammatical principles are common in all languages (Kager, 1999).

Gnanadesikan (2004) argues that Optimality Theory can provide a framework on how child and adult phonology is related and how development progresses through different constraints, which are ranked differently from language to language. This therefore shows that the constraints are universal and even possibly innate (Gnanadesikan, 2004). The initial state of a child's phonology is one where constraints against phonological markedness outrank the faithfulness constraints. The child begins to favour unmarked outputs, but there is still a particular ranking of unmarkedness and faithfulness in the child's target language. As the child develops

further, the need for faithfulness will begin to be dominant and the child will be tasked with re-ranking the constraints accordingly (Gnanadesikan, 2004).

The paper looked at the phonology of the researcher's daughter, Gitanjali, a 2-year-old raised in a monolingual Standard American English environment (Gnanadesikan, 2004). The period of study was between the ages of 2;3 to 2;9. The paper demonstrates that the underlying forms of G's speech are segmentally accurate as they contain the phonemes of the adult form but certain markedness constraints are ranked above faithfulness constraints. G produces syllables that have at most one consonant in the onset position (Gnanadesikan, 2004). The unmarked structure of G's onsets is as a result of ranking the markedness constraint *COMPLEX above faithfulness. Although the segment numbers of G's onsets are maximally unmarked, there is variation in markedness in the sonority of the onset (Gnanadesikan, 2004). When there is only one consonant available for the onset position, then G will use it regardless of how marked an onset it makes. However, when there is a choice of onset consonants her grammar will select an onset, which is least sonorous, and thus the least marked syllable (Gnanadesikan, 2004).

*COMPLEX and sonority

In G's language, syllables will begin with at most one consonant. Any onset that is complex must therefore be reduced to a single segment (Gnanadesikan, 2004). Such reductions are:

10) 'clean' [kin]
'please' [piz]
'friend' [fɛn]

The proposed constraint to rule out outputs that do not conform to G's grammar is *COMPLEX. This markedness constraint is therefore unviolated in G's grammar (Gnanadesikan, 2004). In the example of 'please' the [p] or the [l] could have been deleted but the first consonant was the surviving one. This means that G not only satisfies the syllable shape but also sonority requirements. The optimal syllable begins

with an onset of low sonority and is followed by a vowel (Gnanadesikan, 2004; Prince & Smolensky, 2004).

One of the more complex aspects of G's language is the use of a dummy syllable fi-, which is used for word-initial unstressed syllables. The following words occur with a dummy syllable:

11) 'mosquito' [fi-giDo]
'rewind' [fi-wayn]
'spaghetti' [fi-g ɛDi]

The fi- syllable appears before a stressed syllable, regardless of the syllable's content in adult language. An unstressed or secondarily stressed syllable will still occur when the segments of the initial unstressed syllable are deleted (Gnanadesikan, 2004). This implies that there is syllable structure is G's speech. Using the dummy syllable fi- G's outputs remain faithful to the input at the syllable level as there is the same number of syllables in the input and output (Gnanadesikan, 2004).

Although a small demonstration of patterns in child speech, the purpose was to demonstrate that OT succeeds in describing child phonology through the comparison of adult forms. An OT model of child phonology accounts for the fact that the child will derive outputs from adult speech, although strongly different, to fit their grammar (Gnanadesikan, 2004). The current study contributes to the work done on phonological acquisition by providing a consolidated set of stages for the acquisition of phonology. These stages are then examined from an OT framework to demonstrate the re-ranking of constraints between each stage.

2.7 Overview of the stages of acquisition

Using parameters, children need to acquire phonology, syntax and semantics. The focus of this study is phonology, but these aspects of a child's grammar need to interact in order for the child to develop full competence (Menn & Stoel-Gammon, 2009). Before children even display any of the vocalisations, they will begin in the

pre-linguistic stage. They begin with simple cries at birth followed by production of complex babbling, which consists of identifiable syllables and adultlike patterns (Menn & Stoel-Gammon, 2009). There are two categories of prelinguistic vocalisations, reflexive and non-reflexive. The reflexive vocalisations consist of cries, coughs and involuntary grunts, which all appear to be automatic responses reflecting on the child's well-being. Nonreflexive vocalisations are not automatic and contain some phonetic features found in adult speech. These vocalisations include cooing, voluntary grunts as well as jargon babbling (Menn & Stoel-Gammon, 2009).

Regardless of the linguistic community of the child, all children will pass through these stages of vocal development. Although these may be referred to as stages they differ from the stages of grammatical acquisition (Menn & Stoel-Gammon, 2009). The vocal development stages overlap each other. This is unlike the stages of acquisition whereby any errors made in the first stage will not be made in the second stage because children are building up the rules and cementing them in place (Menn & Stoel-Gammon, 2009). Table 3 highlights the stages, ages, as well as the vocalisations found at each stage:

Table 3: Stages of vocalization (Menn & Stoel-Gammon, 2009 p.70)

Stage	**Age**	**Characteristics**
1: Reflexive vocalisations	Birth to 2 months	Crying, fussing, coughing. Some vowel-like sounds may also appear but limited due to the vocal tract size.
2: Cooing and laughter	2 to 4 months	Comfort-state vocalisations such as cooing. These sounds appear to be produced in the back of the mouth.
3: Vocal play	4 to 6 months	Testing of the vocal apparatus begins, either by producing soft and loud

		sounds or high and low pitches.
4: Canonical babbling	6 months to older	The main feature of this stage is the appearance of sequences of consonants and vowels
5: Jargon	10 months and older	This stage overlaps with the early stage of meaningful speech. It is characterised by strings of sounds and syllables.

Between the ages of six and 12 months, the repertoire of sounds that the child can produce expands considerably; this is similar across languages. The common misconception made about babbling was that it was just a gap between birth and speech development, an empty period (Menn & Stoel-Gammon, 2009). As stated in the previous chapter, babbling is the pre-cursor for speech. Some of the sounds produced during babbling coexist with other speech sounds (Stoel-Gammon & Sosa, 2009).

Progressing from the vocalisation stages of speech to the stages of acquisition of speech sounds, a child needs to discover the units that are required in order to map out and categorise speech sounds in their linguistic community. However, certain anatomical factors will play a crucial role in pacing the child during acquisition, as their vocal tract develops, so does their vocabulary (Vihman, 1996).

The emergence of child language is commonly referred to as grammar. Mature language users are able to understand and produce an infinite number of utterances. This can only happen if they acquired the grammar for their language during childhood (O'Grady & Cho, 2001). Simply memorising or repeating a set inventory of words would not equip learners of a language to deal with any unheard utterances, which is one of the fundamentals of language use (O'Grady & Cho, 2001).

Another indication to suggest that children acquire grammatical rules rather than a set list of words is the errors they make. When talking to a child, the parent or caregiver will not teach the child errors. These provide valuable clues into how the process of acquisition works (O'Grady & Cho, 2001). Such errors like the over-generalisation of the past tense suffix –ed demonstrates that the child is applying their own rules as they progress through acquisition. An adult would not utter the incorrect tense of 'go' as [goed], but a child will produce this, which supports that rules are acquired rather than just words. They create their own rules from what they have heard (O'Grady & Cho, 2001).

Children will extend regular grammatical patterns onto irregular words, resulting in the process mentioned above, over-generalisation. In English, this is due to the two ways that are used to create inflected forms. In most cases, the suffix –ed is added to the verb stem in order to form the past tense, but there are as many as 180 irregular verb forms in English. As a result, the child produces the form [goed], demonstrated above. These error patterns reveal a creative process of a mental operation that is implementing the –ed suffixation rule. Children will rework the rules as they progress, supporting the view that rules are acquired rather than just words (Marcus et al., 1992)

All children, even deaf children, progress through these stages while acquiring the grammatical rules of their language. The first stage where children begin to show the ability for speech begins to emerge at around six months; this is the onset of babbling. This stage provides children with the opportunity to experiment with their vocal apparatus and learn to gain control (O'Grady & Cho, 2001). At this stage there is emergence of canonical babbling where we start to see sequences of consonants and vowels (Menn & Stoel-Gammon, 2009). This is an important step when learning language. Children who are unable to babble, due to medical reasons such as a breathing tube, will acquire normal pronunciation but their development will be significantly slower than that of a child of the same age that can babble, as babbling is a pre-cursor for speech (Stoel-Gammon & Sosa, 2009). Despite the significant differences among languages, children brought up in different linguistic communities will show similar patterns in babbling. These early similarities suggest that early

babbling is partly independent of the language to which the child is exposed (O'Grady & Cho, 2001).

The next stage begins between the ages of 12 to 18 months and children will then progress to the one-word stage. The significance of the one-word stage is to express a type of meaning that would ordinarily be expressed with an entire sentence in adult speech. These words can also be called holophrases, which means 'whole sentence'. It is at the age of 12 months that utterances start to become audible (Chiswanda, 1994; O'Grady & Cho, 2001). The children will choose a word that is informative enough in the context of the environment. If they want candy, then the child will say 'candy' rather than 'want' as this provides more information. While children may only be able to say a few one-word utterances, their comprehension is more advanced than their production. This can be seen with the example of candy, while they only uttered one word they understood what was being asked of them (O'Grady & Cho, 2001).

Within a few months of the first-word stage, children will begin to produce two-words, otherwise known as 'mini sentences'. While it is unclear whether the syntactic categories, such as the noun or verb, are in place at this stage of development, this is due to the absence of markers such as past tense suffix or inflections during this period. In Shona, there is also an absence of noun and verb inflectional morphemes at this stage (O'Grady & Cho, 2001; Sibanda, 2014). Although these categories seem to be lacking, there is evidence that there is appropriate word order in almost all two-word utterances. This suggests an early sensitivity to the feature of sentence structure, however, it is strongly argued that children generally do not have a word order rule but rather a separate rule for each verb, e.g. put the subject in front of the verb 'push' (O'Grady & Cho, 2001).

After several months of producing speech limited to one or two words, the child will progress into the telegraphic stage. These are longer and more grammatical structures. There is a an emergence of elaborate type phrases and from this point on, language development is rapid (O'Grady & Cho, 2001). Table 4 provides the age and summary of each stage:

Table 4: The development of phrase structure (O'Grady & Cho, 2001 p. 348)

Stage	Approx. age	Developments
Holophrastic	1 – 1,5 yrs	Single word utterances with no structure
Two-word	1,5 – 2 yrs	Word combinations but syntactic structures unclear
Telegraphic	2 – 2,5 yrs	Phrase structures produced

Within each of these stages, there are also phonological elements that are specific to the age of the child; as they master the language of their linguistic community, their phonological development resembles adult speech. By the time children have acquired about 50 words, normally around the age of 18 months, they begin to adopt regular forms of pronunciation. These forms vary from child to child regarding which sounds are mastered in which order, however, there are some general tendencies that exist (Demuth, 1995; Ferguson & Farwell, 1975; O'Grady & Cho, 2001).

- In general, vowels are acquired before consonants by the age of three.
- Stops tend to be acquired before other consonants.
- Regarding place of articulation, labials are often acquired first, followed by alveolars, velars and alveopalatals, but with some variation. Interdentals are acquired last.
- New phonemic contrasts manifest first in the word initial position. The [p]-[b] contrast will appear as [pat]-[bat] before [mop]-[mob].

By the age of four, this inventory is considerably larger but interdental fricatives and the voiced alveopalatal fricative is still to be acquired. The general rule is that the acquisition of sounds reflects the distribution of the sounds in a particular language (O'Grady & Cho, 2001). At this age, the utterances are now more intelligible but still contain error patterns such as over-generalisation. There is also more control of articulatory facets (Kuijpers, n.d.; Stoel-Gammon & Sosa, 2009).

Syllables bearing primary or secondary stress are more salient to children than the unstressed counterparts during the early stages of acquisition and are subject to

change or repair strategies in order for the syllable to fit into the child's grammatical rule. Often a child will simplify the syllable structure by deleting certain sounds. In English 'try' will be produced as [taj] and 'sleep' will be [sip]. This is due to the complex consonant cluster that is not a part of the child's grammatical structure or rules as yet. Another common strategy is deletion of the final consonant, 'boot' will becomes [bu]. Both these reduction strategies aid in simplifying the syllable structure in order to bring it closer to resemble the consonant-vowel (CV) structure, that is favourable universally by children (Lust, 2006; O'Grady & Cho, 2001; van de Weijer, 2017).

Another strategy used by children is to substitute. This involves the systematic replacement of one sound by an alternative, one that the child finds easier to articulate (Lust, 2006; O'Grady & Cho, 2001; Rose & Inkelas, 2011). Common substitution processes include stopping, a fricative is replaced with a stop; fronting, this involves moving sounds forward in the mouth, as they are easier to articulate; gliding, this is the replacement of a liquid by a glide; and denasalisation, a nasal stop is replaced by a non-nasal counterpart (Lust, 2006; O'Grady & Cho, 2001; Rose & Inkelas, 2011).
Table 5 shows examples of the processes that children use when acquiring their native language in order for the construct to fit into their grammatical rules at a particular age:

Table 5: Substitution in early speech (O'Grady & Cho, 2001 p. 334)

Process	**Example**	**Change**
Stopping	sing ➔ tɪŋ	s ➔t
	zebra ➔dibrə	z ➔d
Fronting	ship ➔sɪp	ʃ ➔ s
	chalk ➔tsɑːk	tʃ ➔ts
Gliding	story ➔stowi	r ➔w
	laughing ➔jæfɪŋ	l ➔j
Denasalisation	room ➔wub	m ➔b
	spoon ➔bud	n ➔d

Around the age of 18 months, the average vocabulary size for a child is 50 words or more. These commonly refer to people, animals, food and drink and toys. The most common to appear are nounlike words and these make up the largest category in the child's vocabulary, followed by verb and adjective like words. By age six, most children have mastered about 13 000 to 14 000 words. Many studies mention the stages of acquisition and what is acquired at around what age, but how do children acquire the meaning of a word? There are three strategies that are employed for learning new word meanings (O'Grady & Cho, 2001 p. 336-337):

- *Whole object assumption*
  The new word refers to an object in its entirety.
  E.g.: when a mother points to a dog, the child infers that it means the animal itself, not the parts or fur.

- *Type assumption*
  The new word refers to a type of thing, not just a particular thing.
  E.g.: when the child sees the dog, they infer that it is a type of animal and not just that one particular dog.

- *Basic level assumption*
  The new word refers to objects that are similar in basic ways, either appearance or behaviour.
  E.g.: this level leads the child to guess that dog is used to refer to a four-legged, furry domestic animal with a tail, and not animals in general.

This type of meaning mapping also leads the child to make errors. In cases of overextension, the child's meaning of a word is more general than the adult form. Such example could include 'daddy' referring to all men. A child may also limit the meaning of a word, known as underextension. The word 'kitty' may refer to the family pet, but does not extend to any other cats (O'Grady & Cho, 2001).

2.8 Summary

This chapter encompassed a review of selected studies, methodologies and findings that provided insight into the topic of investigation. The current chapter also presented an overview of the stages of acquisition as well as the types of patterns children employ when acquiring their grammar. Shona and Bantu acquisition was also addressed in the current chapter. What is made clear in this chapter is that there is an argument for language parameters that become more defined as the child progresses through the stages of acquisition. The usage and practice of these parameters will cement them in place. Such evidence to support that parameters are acquired and not words is the errors made. Children will not be taught errors by their caregivers so they over generalise a rule that is in place. As they mature the rule is more refined and will resemble that of an adult. Not only are these parameters said be similar across all children but anatomically children all begin the same, with exception of any pathologies or abnormalities. Organs for speech production take time to mature and will limit all children to certain sounds until they mature. The subsequent chapter provides the methodology of the current study and the method of data analysis.

Chapter 3

Data gathering and Analysis Techniques

3.1 Introduction

Chapter 2 presented a review of previous studies on the stages of child language acquisition as well as background into the study of acquisition. What was made clear is that there is a set of stages that all children follow. Even children acquiring a Bantu language will progress through stages in order to acquire noun class, which are not present in other languages. It is the progression from each stage that is addressed in the current study. This chapter presents a detailed account of the archival data used. This includes the methods used to gather, verify and analyse the data that the researchers used. The analysis presented in the current study is couched in Optimality Theory, and is briefly discussed in this chapter. OT will demonstrate the progression from one stage to the next in this study.

3.2 Sources of data

The studies chosen for the current study used different methods of data collection in order to present their findings. In order to study the process of acquisition in children, two methods of data collection are used – naturalistic observation and experimentation (O'Grady & Cho, 2001). The data used in the current study is a collection of archival data that used both methods of collection. In a naturalistic approach, the investigators will observe the child and record the spontaneous utterances; one method of doing so is with the use of a diary (Mudzingwa, 2001; O'Grady & Cho, 2001). The researcher, often a parent, will keep daily updates on the child's linguistic progress. Another, more systematic, approach to collect data in a naturalistic setting is through the use of regular taping sessions in order to gather a large sample of data. By collecting data through a naturalistic setting, it shows how the language acquisition process unfolds (O'Grady & Cho, 2001).

Unfortunately, with all data collection there are shortcomings. The biggest one with this method of data collection is that the particular phenomena and structures that

occur during language acquisition do not occur on a daily basis (Mudzingwa, 2001; O'Grady & Cho, 2001). This makes gathering enough data from natural speech samples, to test hypotheses, more difficult. In an experimental study, researchers will make use of specially designed tasks in order to elicit a certain response for the phenomena being tested; this could either be comprehension, production or imitation. This will then provide hypotheses about the type of grammatical system and when this will be acquired. The responses to these tasks provide valuable clues about the types of grammatical rules that are being used to interpret the sentences during the various stages of acquisition (O'Grady & Cho, 2001).

The data in this study are archival data collected by Chiswanda (1994), Mudzingwa (2001) and Sibanda (2014). Using archival data from 3 sources allowed for a more thorough comparison. 180 words were selected at random for the current study and were made up of 60 words from each of the previous studies mentioned above. Mudzingwa (2001)'s document is a Masters dissertation that focused on the phonology of the researcher's daughter, see appendix 3 for the words selected for the current study. The age bracket that was examined was between the period of one year and three months and three years old. The researcher used a naturalistic method to collect the data from his daughter and recorded her utterances during this time.

The data in Mudzingwa (2001) were analysed using the phase word template, phase syllable template and the subsidiary word template. A phase referred to a period in which words shared particular phonological characteristics and were governed by the phase word template, which shaped the types of words used. The phase syllable template governed the size of the preferred syllable structure. Lastly, the subsidiary word template demonstrated a continuation of constraints from the earlier phase (Mudzingwa, 2001). Building on these phases, the current study will examine the stages in which these words fall into and account for the re-ranking of constraints.

The data presented in the PhD thesis by Sibanda (2014) were collected from four Shona speaking children, two male and two female, these words can be found in appendix 2. The age range was from two years to three years and two months (Sibanda, 2014). Sibanda (2014) used both a naturalistic and elicitation method of

data collection. This provided a more enhanced quality of data, that is not always provided by only one method (Sibanda, 2014).

Chiswanda (1994) carried out the study by following four children between the ages of 12 and 25 months who lived in Harare. All utterances were recorded in a naturalistic setting and a speech diary was kept for each child during this time (Chiswanda, 1994). See the data selected from Chiswanda (1994) in appendix 1.

The choice to use archival data was its convenience due to the time constraints on a master's dissertation and access to the language of choice was limited due to its limited community in South Africa.

As the data is from previous studies, ethics clearance is not required. The archival data used in the current study will provide a qualitative analysis of the speech produced in early acquisition. Qualitative research provides interpretive result to questions that require descriptive answers. This research method is centered on a humanistic orientation. The data collected was based in a naturalistic environment where there would be no manipulation of results (Guba & Lincoln, 1994; Sibanda, 2014).

3.3 Method of data analysis

The overall analysis in this study is couched within OT, to account for the differences between each stage of acquisition in order to show the ranking and re-ranking of constraints by Shona children in each stage of acquisition.

3.3.1 Optimality Theory

Optimality Theory is known as the linguistic theory of the 1990s and was first introduced by Alan Prince and Paul Smolensky (Prince & Smolensky, 2004). OT is based on a set of inputs and outputs in order to find the best outcome for any language concerned. The theory presents a set of violable constraints that show how the properties of languages are universal (Archangeli, 1997).

The idea of this theory is that there are two values present in all linguistic structures, namely, marked and unmarked. Cross-linguistically during acquisition, unmarked values are preferred, such as the disyllabic form [mama], while marked values like complex onsets are avoided; [bok] for 'broke' to eliminate a consonant cluster (Lust, 2006). The counterpart to markedness is faithfulness. A candidate that is maximally faithful is the optimal outcome as it is in agreement with the input; examples of this include FAITH-C and FAITH-V. The changing of a consonant or vowel from the input candidate would result in these constraints being violated as the output does not appear the same as the input (Kager, 1999).

Whether or not a violation is fatal is determined by the constraint ranking in the language concerned. In OT, the form is known as a candidate and the goal of this theory is to eliminate the marked candidates in favour of the unmarked candidates (Kager, 1999). What determines the preferred output is the candidate that has the least number of violations of constraints within the grammar concerned. Constraints are requirements made about the grammatical output, but typically, the constraints are in constant conflict, as one constraint will be satisfied, another will be violated.

There are three basic principles on which the OT theory operates, Generate, Constraint and Evaluate. These principles are explained below:

- GEN (Generator); the GEN produces a list of possible outputs or candidates from the given input (Archangeli, 1997).
- CON (Constraints); these are universal sets of constraints. In all languages there are a set of strictly ordered violable constraints. The optimal candidate is determined by how the constraints are ranked in a language (Archangeli, 1997).
- EVAL (Evaluation); EVAL uses the hierarchy of constraints within a language and chooses the optimal candidate in order to produce the GEN (Archangeli, 1997).

For any given lexical input, there are a number of potential outputs that are generated. The hierarchy of the constraints will select an output that best satisfies these

constraints. The constraint ranking and their effects on outputs are represented in tableaux (Gnanadesikan, 2004). The following tableau shows the representation of constraint ranking:

Tableau 1: Example of OT analysis

(1)	Constraint A	Constraint B
Candidate 1	*!	
✓ Candidate 2		*

In Tableau 1, constraint A dominates constraint B. Any candidate that violates constraint A will not be the optimal candidate as constraint A is ranked higher that constraint B. The optimal candidate will be one, which satisfies constraint A and violates constraint B instead. The constraint violations are shown with an asterisk and candidates that are eliminated from consideration are marked with an exclamation mark (Gnanadesikan, 2004).

The advantage of using OT is that it demonstrates the re-ranking of constraints in different languages of the world. As constraint ranking is language dependent, the results of this study demonstrate how Shona children would re-rank constraints according to the stages of phonological acquisition set out. The linguistic variation in all languages can be accounted for in OT. The variation between the stages of acquisition found in this study demonstrates that the variation between each stage is as a result of constraint re-ranking.

In the early stages of acquisition, the child will show preference for disyllabic words, but around three years of age there is an emergence of trisyllabic words. This demonstrates that there is a re-ranking of a constraint that concerns disyllabic forms (Demuth & Morgan, 1996; Pater, 1997). In the early stages, this will be high ranked but as the child progresses and the consonant inventory expands, this constraint will be low ranked and violable. As the consonant inventory expands, there are complex onsets seen in a child's speech. The markedness constraint *COMPLEX is high ranked and cannot be violated, but as the child's phonology expands, this constraint is low ranked in order to allow for the complex onsets (Archangeli, 1997).

3.4 Summary

This chapter presented a brief discussion of the methodological approaches employed in this study. A total of 180 Shona child utterances were chosen randomly from the three previous research papers, 60 from each study, these can be found in appendix 1, 2 and 3. Optimality Theory was the theoretical approach used to analyse the data. OT provides an insight into the constraint re-ranking employed by Shona-speaking children during early acquisition. The child utterances were compared to the adult counterpart and at each stage of acquisition a different output form was generated. It is these output forms that demonstrate the re-ranking of constraints through each stage and is at the core of the current study. The following chapter presents an analysis and explanation of the data.

Chapter 4

Data Analysis and Discussion

4.1 Introduction

The previous chapter discussed the sources of data for the current study. This study used a random selection of words from the studies in order to produce a list of words to be analysed. A brief discussion of the theoretical framework that underpins this study - OT - was given. This chapter presents a formal analysis of the data. The data in this chapter appears in its original form from the original sources.

As mentioned in a previous chapter, children will employ the strategy of constraint re-ranking in order to produce constructs that are permissible in the child's grammar during early acquisition. As the child progresses and gets older, these constraints will resemble those of an adult. The following analysis looks at the three early stages of acquisition.

4.2 Stage 1: Holophrastic stage (1 – 1,5 years)

After the child has progressed through the prelinguistic stage, they will progress through to the first stage. The first stage, known as the holophrastic stage, sees the emergence of one-word constructs. These will typically express meaning by referring to particular objects. These object references however, show a more advanced comprehension than production. When an adult refers to an object, the child will understand the reference. This stage typically lasts between the ages of 1 -1,5 years (O'Grady & Cho, 2001). This stage demonstrates a preference for disyllabic constructs, which is common in most languages during this stage (Chiswanda, 1994; Demuth & Morgan, 1996).

4.2.1 Optimal word size

Table 6 demonstrates the preference for disyllabic forms in Shona acquisition.

Table 6: Optimal word size

Adult form	Child form	Gloss
[ba.na.na]	[na.na] [ba.ba]	banana
[mu.ka.ka]	[a.ka]	milk
[re.di.o]	[a.di]	radio
[ndi.po.wo]	[po.wo]	may I leave?

Table 6 shows the syllable size of Shona children between the ages of 1 and 1,5 years. The preferred word size is two syllables. When presented with a word that contains more than two syllables, the child reduces the word to their preferred size; two syllables (Chiswanda, 1994; Mudzingwa, 2001). This is also seen in English-speaking children, 'banana' is produced as [na.naə] (Lust, 2006). In order to account for this realisation, we must appeal to a markedness constraint, which prohibits words that are smaller than or larger than two syllables. These types of constraints exert pressure within a language towards an unmarked form. Tableau 2 formalises the realisation of the optimal word size in Shona child phonology. The constraint that prohibits a word size greater or smaller than two syllables is defined in (12). Tableau 2 formalises the realization of *ba.na.na* in Shona.

12) FTBIN – this constraint bounds both the upper and lower size on the foot. The construct may neither be monosyllabic nor larger than binary (Pater, 1997 p.208).

A faithfulness constraint that prohibits the deletion of segments is MAX-IO. This constraint is defined in (13) below:

13) MAX-IO – input segments must have a corresponding output segment. Deletion is not permissible (Kager, 1999 p.102).

MAX-IO is ranked below the markedness constraint FTBIN and is therefore low ranking in Shona. As a result, it incurs a non-fatal violation. This is demonstrated in tableau 2:

Tableau 2: Optimal word size

FTBIN>>MAX-IO

/banana/	**FTBIN**	**MAX-IO**
a) [ba.na.na]	*!	
b) [ba.]	*!	****
c) ➔[na.na]		*

Candidate (a), which is fully faithful to the input, is not optimal as it fatally violates the high-ranking constraint FTBIN, as it is larger than the preferred disyllabic form. Only two syllables are acceptable at this stage. Candidate (b), which truncates the word to a monosyllabic word fatally violates a high-ranking constraint FTBIN. Monosyllabic words are non-optimal at this stage of acquisition. The preference for a disyllabic word is highly ranked in a child's grammar, therefore a word containing less than two syllables fatally violates the high-ranking markedness constraint FTBIN. The violable constraint is MAX-IO, as candidate (c) showing, that the input need not be the same as the output and deletion of a segment is permissible (Kager, 1999; Pater, 1997).

4.2.2 Fricative replaced with a stop

Table 7 demonstrates the prohibition of fricatives and the common process of replacing them with a stop (Lust, 2006; Pater & Barlow, 2003).

Table 7: Fricative replaced with a stop

Adult form	Child form	Gloss
[**s**i.**s**i]	[**t**i.**t**i]	sister
[ko.**s**i]	[ko.**k**o]	kosi
[**s**i.ja]	[**t**i.ja]	leave
[**s**a.d**z**a]	[**t**a.**t**a]	cornmeal/sadza

In Table 7, fricatives are replaced with stops, as children prefer stops during this stage of acquisition. Stops are the first sounds to appear in English-speaking children and they start to appear at 11 months. English-speaking children and Shona-speaking children replace fricatives with stops. In English, 'shoes' is produced as [tuid] (Lust, 2006). Fricatives are the last sounds to appear due to physiological development of children (Chiswanda, 1994; Ferguson & Farwell, 1975). In order to account for this stopping process, we must appeal to the segmental markedness constraint that bans the use of fricatives, which is defined in (14). Tableau 3 demonstrates the process of stopping in *si.si* in Shona child phonology.

14) *FRICATIVE – segments may not be a fricative (Pater & Barlow, 2003 p.495)

The faithfulness constraint that prohibits consonant or vowel feature changes is IDENT-IO is defined in (15).

15) IDENT-IO – segments in the output are identical to segments in the input (McCarthy & Prince, 1995 p.16)

IDENT-IO is ranked below the markedness constraint *FRICATIVE, which prohibits fricatives at this stage of language acquisition. Therefore IDENT-IO is a low ranked constraint in Shona acquisition. As a result, it incurs a non-fatal violation. This is demonstrated in tableau 3:

Tableau 3: Fricative replaced with a stop

***FRICATIVE>>IDENT-IO**

/sisi/	*FRICATIVE	IDENT-IO
a) [**s**i.**s**i]	**!	
b) ➔[**t**i.**t**i]		**

Candidate (a), which is fully faithful to the input, is not the optimal candidate as it fatally violates the high-ranking constraint *FRICATIVE which prohibits the use of fricatives in the child's grammar at this stage of acquisition. Candidate (b) replaces fricatives with plosives in order to satisfy the high ranking *Fricative. Its violation of IDENT-IO twice is inconsequential as this is a low ranking constraint. Feature changing is permissible in child grammar (McCarthy & Prince, 1995; Pater & Barlow, 2003).

4.2.3 Voicing of voiceless consonants

Table 8 demonstrates the process of replacing a voiced consonant with a voiceless consonant.

Table 8: Voicing of voiceless consonants

Adult form	Child form	Gloss
[**b**a.**b**a]	[**p**a.**p**a]	daddy
[**p**e.**r**a]	[**p**e.**p**e]	there is nothing more

Table 8 shows a preference for voiceless consonants in Shona-speaking children. This is the opposite that is seen in English, there is preference for voicing the initial consonant. This is seen in 'pie' being produced as [bie] (Lust, 2006). When presented with an adult form that contains voiceless consonants the child will maintain the utterance. Phonologists agree that the [b] is mastered before [p] or [d], however, plosives are mastered in a different order, but they will appear before the fricatives (Kuijpers, n.d.).

As illustrated in table 8, the opposite is the case for Shona-speaking children. The [p] is produced instead of the [b] but plosives appear before fricatives. In order to account for the pressure exerted in Shona child phonology, we appeal to a specific markedness and faithfulness constraint. Tableau 4 formalises the realisation of a voiced consonant as a voiceless consonant. The markedness constraint that prohibits voiced obstruents (fricatives or plosives) is defined in (16). Tableau 4 formalises the realisation of *ba.ba* in Shona.

16) VOP – no obstruent may be voiced (Kager, 1999 p.398)

The faithfulness constraint IDENT-IO that prohibits consonant and vowel feature changes is defined in (15) above, this is dominated by the markedness constraint in (16) above. The voicing of voiceless consonants is formalised in tableau 4 below.

Tableau 4: Voicing of voiceless consonant

VOP>>IDENT-IO

/baba/	**VOP**	**IDENT-IO**
a) [**b**a.**b**a]	***!**	
b) ➔[**p**a.**p**a]		*

Candidate (a), which is fully faithful to the input, is not the optimal candidate as it contains voiced consonants. It fatally violates VOP. Voiceless sounds are preferred at this stage of acquisition to voiced ones. Thus, the voiced plosive [b] is not optimal. Therefore, the optimal candidate is (b) as it violates the low-ranking constraint IDENT-IO. Consonant changes are permissible in Shona child grammar (Kager, 1999; McCarthy & Prince, 1995).

4.2.4 Stage 1 Summary

To sum up the stage ranking in the first stage of Shona acquisition, we can formalise the non-violable and violable constraints as follows:

17) FTBIN, *FRICATIVE, VOP>>IDENT-IO, MAX-IO

In stage 1 there is a preference for disyllabic forms and any form larger or smaller than disyllabic will violate the high-ranking constraint FTBIN. The child does not yet have fricatives in their vocabulary, thus the constraint *FRICATIVE is high ranking and prohibits fricatives such as [s] or [f], therefore the child will replace any fricative with a stop, the process known as stopping (Lust, 2006; Pater & Barlow, 2003). Unlike English, there is a preference for voiceless consonants in Shona. The constraint VOP prohibits voiced consonants; the child therefore replaces these with voiceless consonants. These constraints are all high-ranked, but will be re-ranked to resemble the adult form as the child matures through acquisition.

In order for the child to construct a grammar that is permissible for a particular age or stage, there will be violable constraints that allow for changes to produce outputs that are acceptable. These constraints are therefore low-ranked. IDENT-IO allowed the child to change a feature of a sound while MAX-IO allowed for deletion of segments that were unacceptable at this stage.

4.3 Stage 2: two-word (1.5 – 2 years)

Stage 2 is classified as the mini-sentence stage. These are still one to two word utterances, but there is evidence to suggest that there is already sensitivity to the features of sentence structure at this stage, however word order rules are lacking (O'Grady & Cho, 2001). The data suggests there is still a preference towards disyllabic constructs at this stage

4.3.1 Fronting initial consonants

Table 9 demonstrates the process of fronting the initial consonant in Shona child phonology.

Table 9: Fronting initial consonants

Adult form	Child Form	Gloss
[**s**a.ra]	[**θ**a.ja]	remain behind
[**t**e.pi]	[**p**e.ti]	tape
[**ɲ**a.ma]	[**n**a.ma]	meat

Table 9 illustrates the fronting of consonants in child phonology. This is for ease of production as there is no change in the position of the articulation. Children have not yet mastered the ability to switch from front to back articulation or vice versa when producing a word. By making the initial consonant the same position, the child will produce this construct with ease (Lust, 2006; Rose & Inkelas, 2011). In order to account for the process of fronting, we appeal to a markedness and faithfulness constraints. These constraints will apply pressure to the language towards the form that is unfaithful to the original input or adult form. Tableau 5 formalises the fronting of the initial consonant in *ɲa.ma* in Shona child phonology. The constraint that prohibits back consonants is defined in (18) below:

18) *$C_{[BACK]}$ – any consonant that is articulated in the back of the vocal tract is not permissible as the palate is still developing (Rose & Inkelas, 2011). Back consonants such as velars or palatals require putting the tongue against the palate (Longman, 2004; Rose & Inkelas, 2011).

The faithfulness constraint that requires input segments to correspond to output segments is defined in (15).

IDENT-IO is ranked below *$C_{[BACK]}$ thus incurs a non-fatal violation during this stage of Shona acquisition. This is demonstrated in tableau 5:

Tableau 5: Fronting initial consonants

***C $_{[BACK]}$>> IDENT-IO**

/ŋama/	*C$_{[BACK]}$	IDENT-IO
a) [ŋa.ma]	*!	
b) ➔[na.ma]		*

Candidate (a), which is fully faithful to the input, is not an optimal candidate as the sound is not the preferred frontal manner of articulation. Sounds produced further back in the mouth are more difficult to produce, therefore *C$_{[BACK]}$ prohibits sounds that are produced further back in the vocal tract. The violable constraint is IDENT-IO, as in candidate (b), showing that it is not required in the child's speech to maintain consonants from the input in the output (Archangeli, 1997; Gnanadesikan, 2004; Rose & Inkelas, 2011).

4.3.2 Complex Segment Simplification

Table 10 demonstrates the simplification of complex segments into simpler forms. Complex segments are produced using two or more articulators (Mudzingwa, 2001). This process is too complicated for children at this stage as they have yet to fully control their articulators, therefore they simplify these complex segments (Ingram, 1986; Kuijpers, n.d.; Mudzingwa, 2001).

Table 10: Complex segment simplification

Adult form	Child form	Gloss
[**ndi**.po.wo]	[po.wo]	may I leave?
[**gw**a.va ri.ri.pi]	[ga.va ji.pi]	where is the guava?
[**ʃ**in.**gw**a]	[ki.ga]	bread
[**mw**a.na]	[ma.na]	child

Children will reduce complex segments by selecting one or more of the sounds to delete. This may be due to their physiological development. Producing a complex segment requires a mastery of the articulatory systems that children have not yet developed. It is at around the age of four that children start to learn to control to motor function of articulation (Kuijpers, n.d.). In order to account for this realisation, we appeal to the markedness constraint that prohibits complex clusters, which is defined in (19). Tableau 6 formalises the complex reduction in Shona child phonology with the example *gwa.va ri.ri.pi.*

19) *COMPLEX – syllables have at most one consonant (Archangeli, 1997 p.8)

The markedness constraint that prohibits insertion is defined in (20).

20) DEP-IO – an output segment must have a corresponding input segment, no insertion (epenthesis) (Kager, 1999 p.68)

COMPLEX and DEP-IO are both high-ranked in Shona, thus they incur fatal violations. As we have established above in (12), the markedness constraint FTBIN is also high-ranked in Shona child speech as it prohibits forms that are monosyllabic or larger than disyllabic. As seen in (13), the markedness constraint MAX-IO is low-ranked in child Shona phonology as deletion of segments is permitted, thus it incurs a non-fatal violation. Tableau 6 demonstrates the process of complex segment simplification in Shona child phonology.

Tableau 6: Complex segment simplification

***COMPLEX, DEP-IO, FTBIN>>MAX-IO**

/gwava riripi/	*COMPLEX	DEP-IO	FTBIN	MAX-IO
a) [gwa.va ri.ri.pi]	*!		**!	
b) [gi.wa.va ri.ri.pi]		*!	***!	
c) ➔[ga.va ji pi]				*

Candidate (a), which is fully faithful to the input, is not an optimal candidate as it fatally violates the high-ranking constraints *COMPLEX and FTBIN, as it contains more than one consonant at a syllable edge and is larger than the preferred disyllabic form. Candidate (b) fatally violates the high-ranking constraint DEP-IO as well as FTBIN. The insertion of a vowel is prohibited in the child's speech and by doing so; it also increases the word size past the preferred two-syllable size. Candidate (c) is the optimal candidate as it violates the low-ranking constraint MAX-IO. Deletion of a segment or segments is allowed in the child's speech (Archangeli, 1997; Kager, 1999; Pater, 1997).

4.3.3 Stage 2 Summary

21) *C $_{[BACK]}$ *COMPLEX, DEP-IO, FTBIN>>IDENT-IO, MAX-IO

In stage 2, there is still emphasis placed on the syllable size, as the child will produce either one or two words that are dysyllabic. This constraint FTBIN is therefore still high-ranked at this stage. As presented in stage 1, fricatives are not preferred, but in the second stage we did start to see simple fricatives being produced, such as (θ). Voiced consonants start to appear but there is still a large number of voiceless consonants in the data, suggesting a preference is still present. The high-ranked constraint *C $_{[BACK]}$ prohibited consonants produced further back in the mouth,

therefore these sounds were fronted. This is for ease of production as they have not yet fully developed to produce sounds further back in the mouth (O'Grady & Cho, 2001; Rose & Inkelas, 2011). Complex clusters started to appear in the second stage and as the child cannot produce clusters together such as [gw], they will simply delete one or more of the segments to simplify it. Therefore MAX-IO is still low-ranked at this stage.

4.4 Stage 3: Telegraphic (2 – 2,5 years)

From the third stage, children will begin to produce utterances longer than the preferred two syllables that are seen in the first and second stage. From this stage onwards, language development is rapid (O'Grady & Cho, 2001). Although the development is rapid, research has said that a child would have not fully developed their speech mechanisms until the age of nine (Kuijpers, n.d.).

4.4.1 Fronting consonants

Table 11 demonstrates the process of fronting word medial consonants. In the previous stage we saw front of the initial consonant.

Table 11: Fronting consonants

Adult form	**Child form**	**Gloss**
[mu.ge.**z**e.yi]	[mu.ge.**ð**e.ji]	Bath him/her
[ho.na ma.**ʂ**o.**ʂ**e]	[ho.na ma.**ʃ**o.**ʃ**e]	look at the ants
[se.fu]	**[θ**e.fu]	surf
[ti.kwi.re te.**s**e]	[ti.ki.je te.**θ**e]	should we ride together?

Although fronting is discussed in the previous stage in table 9, during this stage of acquisition the fronting also occurs word medially and not only initially. As table 11 shows, there is still a preference for fronted sounds, as they have still not acquired full motor control over the articulators. This will start to refine at around the age of four (Kuijpers, n.d.). Table 11 also shows that the sounds affected are fricatives. These sounds are the most commonly affected sounds in child language acquisition and the

repair strategy is to produce a more frontal sound (Ingram, 1986). As demonstrated in tableau 5, the child will still appeal to the same faithfulness constraints in order to deal with the process of fronting. Tableau 7 demonstrates the realisation of fronting from the adult form into the child form.

The markedness constraint that prohibits back consonants is defined in (18) and the faithfulness constraint that requires input and output segments to correspond is defined in (15).

Tableau 7: Fronting consonants

***C $_{[BACK]}$>> IDENT-IO**

/ti.kwi.re te.**s**e/	***C $_{[BACK]}$**	**IDENT-IO**
a) [ti.kwi.re te.**s**e]	***!**	
b) ➔[ti.ki.je te.**θ**e]		*

Candidate (a), which is fully faithful to the input, is not the optimal candidate as the identity of the sound is not permissible in the child's grammar. In the case above, the sound produced is closer to the back of the mouth, which the child has not yet mastered, therefore the *C $_{[BACK]}$ constraint is high ranked regarding a particular place of articulation, sounds produced at the back of the mouth. Candidate (b) is the optimal candidate as it is permissible for the child to change the consonants to another in order for the construct to fit into the child's speech, remaining faithful to the corresponding consonant in the output in low-ranked in Shona child phonology Therefore IDENT-IO is the violable constraint (Archangeli, 1997; Lamont, 2015).

4.4.2 Complex Segment Simplification

Table 12 shows the simplification process demonstrated by Shona children during acquisition.

Table 12: Complex segment simplification

Adult form	**Child form**	**Gloss**
[mŋa.ri]	[ma.ji]	God
[mi.ja **nd**i.ɓike]	[mi.ja pike]	let me cook
[bu.ru.**gw**a ra.ɗo.na]	[bu.ju.ga ɗo.na]	the pant has fallen
[ɓa.ɓa **nd**i.mi.ri.re]	[ɓa.ɓa mi.ji.je]	father, wait for me

Table 12 shows that complex segments must still be simplified during the third stage. These sounds in table 12 require coarticulation and this is not yet in place at this stage but will only develop after the age of three or four (Kuijpers, n.d.) Consonant segment simplification can also be seen in the German example; 'fliegen' 'fly' [fi:kən] and in the English example; 'dress' [dɛs] (Ingram, 1986). Although the constraints that exert pressure on these constructs are similar to those seen in tableau 6, we do start to see the emergence of constructs larger than the preferred disyllabic forms. Tableau 8 formalises the realisation of *ɓa.ɓa ndi.mi.ri.re***.**

As we have established above in (13), the markedness constraint MAX-IO is low-ranked in child Shona phonology as deletion of segments is permitted. As with the previous stage *COMPLEX and DEP-IO are also highly ranked at this stage of acquisition. Although the constraints rankings are the same, we do start to see utterances larger than the preferred size in the previous stages.

Tableau 8: Complex segment simplification

***COMPLEX, DEP-IO, >>MAX-IO**

/ɓaɓa ndimirire/	*COMPLEX	DEP-IO	MAX-IO
a) [ɓa.ɓa ndi.mi.ri.re]	*!		
b) ➔[ɓa.ɓa mi.ji.je]			*
c) [ɓa.ɓa ni.di.mi.ri.re]		*!	

Candidate (a), which is fully faithful to the input, is not the optimal candidate as it contains a complex cluster that is prohibited in the child's grammar. This fatally violates the high-ranked constraint *COMPLEX. Candidate (c) fatally violates the high-ranking constraint DEP-IO, which does not allow the insertion of a vowel between complex segments Candidate (b) is the optimal candidate as it violates the low-ranking constraint MAX-IO, deletion of a segment is permissible (Archangeli, 1997; Kager, 1999).

4.4.3 Sound substitution (r-j)

Table 13 demonstrates the process of changing an [r] into a [j] in Shona child phonology.

Table 13: Sound substitution (r-j)

Adult form	Child form	Gloss
[si.po ʔi.**r**i.pi]	[θi.po **j**i.pi]	where is the soap?
[mo.**r**o]	[mo.**j**o]	hello
[mi.**r**a fa.**r**i]	[mi.**j**a fa.**j**i]	wait,fari
[ba.si.ko.**r**o]	[ba.θi.ko.**j**o]	bicycle

Table 13 demonstrates the process of gliding, where a liquid, either [r] or [l], is replaced with a glide, either [w] or [j]. This repair strategy may be due to the influence of the child's phonological system, as they may not have it in their vocabulary as yet, or the articulation process may be beyond what they have mastered thus far (Ingram, 1986). In order to account for the sound substitution, we must appeal to the markedness constraint, which prohibits [r], which is defined in (22). Tableau 9 formalises the change of *mira fari*. The faithfulness constraint that requires corresponding input segments be present in the output is defined in (15).

22) *r – the sound is prohibited in the Shona child phonology in this stage

*r is ranked above IDENT-IO as the place of articulation for [r] is not preferred or permissible in the child's speech, therefore it is changed to the preferred [j]. The violable constraint is IDENT-IO and can incur a non-fatal violation.

Tableau 9: Sound substitution (r-j)

***r>>IDENT-IO**

/mira fari/	***r**	**IDENT-IO**
a) [mi.ra fa.ri]	****!**	
b) ➔[mi.ja fa.ji]		**

Candidate (a), which is fully faithful to the input, is not the optimal candidate as it contains sounds not permitted in the child's speech. This could be due to lack of ability in producing these sounds. Candidate (b) is the optimal candidate as it violates the violable constraint IDENT-IO, which states that the same consonants in the input must appear in the output (Archangeli, 1997; Lamont, 2015).

4.4.4 Stage 3 summary

23) *$C_{[BACK]}$, *COMPLEX, DEP-IO, *r >>IDENT-IO, MAX-IO

In the third stage of acquisition, there is no longer a preference for constructs that are disyllabic as the utterances increase from this stage on and get larger and more elaborate as the child gets older. There are more fricatives that start to appear but some still remain difficult and will appear later in acquisition (Ferguson & Farwell, 1975; O'Grady & Cho, 2001). *C $_{[BACK]}$, *COMPLEX, DEP-IO, still remain high ranked at this stage as certain places of articulation are dis-preferred and complex clusters are still too complicated to produce. DEP-IO remains high at this stage as vowel insertion is prohibited in Shona acquisition. Remaining faithful to consonants in the input and output is violable as feature change is permissible. Deletion of a segment is still permissible at this stage. *r is ranked high in stage three but the preference for the replacement of an [r] with a [j] is also seen in stage two.

4.5 Summary

This study focused on presenting a formal OT analysis of the constraint re-ranking in Shona child acquisition. A number of examples were presented in this chapter, using tables, along with a brief discussion on each. This was followed by tableaux providing the OT analysis, along with a discussion. During each stage of acquisition certain constraints were ranked higher than compared to the adult form. This is in order for the utterance to conform to the child's current state of grammar. As they progress these constraint rankings resemble the adult form. The data presented above contributes a small part to the area of Bantu language acquisition and the brief analysis done demonstrates the ranking and re-ranking of a few constraints in Shona acquisition.

Chapter 5

Conclusion and Recommendation

5.1 Introduction

The preceding chapter presented the results of the study and demonstrated the processes and constraint re-rankings that occur during each stage of acquisition identified. This chapter summarises the objectives and findings of this study. These objectives will be posed as questions in order to assess whether the current study answered these. It briefly outlines the previous works and literature that have contributed to the study of acquisition. It also recommends areas that may require further exploration.

5.2 Summary, Conclusions and Recommendations

This study set out to identify and characterise the stages of acquisition, from previous research and literature, regarding syllables and segments. These stages were applied to Shona in order to demonstrate whether there was a similar path of acquisition or a difference. To account for the differences between each stage, OT theory was used to demonstrate the re-ranking of constraints between each stage.

Considering these objectives, this study explored prior studies and research on acquisition and phonological acquisition. This provided useful background into the path of study on acquisition as well as the areas of most interest. The focus of this study was to contribute to the research done on Shona acquisition. The data analysed in this study were collected from previous research done on Shona acquisition. A total of 180 words were selected for analysis, 60 words were chosen randomly from the previous studies. The method used to analyse the data was Optimality Theory (OT). This method was used to provide a constraint-based analysis of the constraint re-ranking during acquisition. OT is renowned in the area of phonology and has been used in a number of prior studies.

On analysis of the data, the following was revealed. As seen with other languages, there is a preference for a disyllabic word structure. This was the case for English, as

well as Sesotho, but not exclusively limited to these languages. This study also found that Shona children also replace fricatives with stops. This was also seen in English. Most literature agrees that stops appear before fricatives, although the order of which stops appear first is not exact. By moving the sounds forward in the mouth, they are easier to produce and preferred by children during acquisition.

Physiologically, the shorter palate and lack of control of the tongue also dictates the sounds produced. In Shona, a voiced initial consonant is replaced with a voiceless consonant, but this is the opposite seen in English. Fronting the initial consonant as well as fronting other consonants within a word was also seen in children acquiring Shona. As mentioned previously, due to the shorter palates, the sounds produced by children will be brought forward in the mouth until they begin to develop further.

Shona children, like English children, will simplify a complex onset or cluster as their initial state of grammar prohibits this construct. The complex onset also creates a syllable structure that does not match their rules. Children in the early stages of acquisition prefer a CVCV structure but complex onset produces a CCVC structure. The last result found was the substitution of an /r/ with a /j/. Replacing a sound with a glide is a strategy also seen in English. Glides appear relatively early in the consonant inventory of children and will replace other sounds, such as liquids or trills.

These results were formalised using OT theory. The theory demonstrated the constraint ranking and re-ranking that occurs at each stage of acquisition. These were as follows:

- Stage 1: FTBIN, *FRICATIVE, VOP>>IDENT-IO, MAX-IO
- Stage 2: *C $_{[BACK]}$ *COMPLEX, DEP-IO, FTBIN>>IDENT-IO, MAX-IO
- Stage 3: *C $_{[BACK]}$, *COMPLEX, DEP-IO, *r >>IDENT-IO, MAX-IO

As the child progresses these constraints will be re-ranked until they resemble the form.

In order to assess whether the study has addressed the objectives set out in chapter 1 they may be posed as questions:

- Did the study identify and characterise the stages of phonological acquisition, regarding syllables and segments?

This study identified 3 stages of acquisition. The first stage is the holophrastic stage. This stage follows the prelinguistic stage and at this stage one word utterances emerge. These typically express meaning by referring to specific objects. While these may seem simple in production they demonstrate a higher-level of comprehension. An adult will refer to an object and present it to the child who understands the reference. The second stage identified is the two-word stage. This stage can be classified as the mini sentence stage. While single words will still appear with 2 words evidence suggests a greater sensitivity to the features of sentence structure. The final stage identified in the study is the telegraphic stage. From this stage onwards development is rapid and the utterances produced will be longer than the preferred disyllabic form seen in the first and second stage.

The next objective or question to be answered was:

- Did the study account for the stages of acquisition in Shona child phonology using OT?

This study presented a comprehensive analysis in chapter 4 of the constraints present during the 3 stages identified, as well the ranking of each constraint during each stage. For example, disyllabicity was preferred in stage 1 and 2 but was low ranking in stage 3.

It is anticipated that this study will contribute, in a small way, to the field of acquisition, particularly the acquisition of Shona. Further research could focus on the particular sound inventory of Shona-speaking children as well as further the research on Shona acquisition.

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Appendix 1: Chiswanda Data

Adult word	Child word	Gloss	Age
sadza	-tadha-	sadza	0;12
baba	-bhabha-	daddy/father	0;12
baba	papa-	daddy	0;12
bhanana	-nana-	banana	0;12
iyo/iro	-yo-	there/that	0;12
kapu	-apu-	cup	0;13
ndipe	-pe-	give me	0;13
famba	-amba-	walk	0;13
hande	-inde-	lets go	0;13
chingwa	-unga-	bread	0;13
Fambai	-ambai-	Fambai (name)	0;14
mota	zhmm	car	0;14
mukaka	-aaka-	milk	0;14
ambuya	vuwa-	granny	0;14
ruma	huma	dangerous object	0;14
nderangu	-aangu	mine	0;15
mama	mami	mum	0;15
orange	-enji-	orange	0;15
redhio	-adhi	radio	0;15
aenda	-yenda	s/he's gone	0;15
uko	-koo	there	0;16
handidi	hatiti	I don’t want	0;16
chidhori/mwana	-nhanha	toy/doll/baby	0;16
vhura	-v(h)ua-	open	0;16
kutamba	-namba	to play	0;16
ndipewo	-mpo.	give me	0;17
asara	-ashaya-	he didn't cone	0;17
redhio	radho	radio	0;17
bhanana	-anana-	banana	0;17
ndibereke	-ndibhabhu-	carry me	0;17
ndinokurova	akuvova	I will hit you	0;18
chihwitsi	chiti	sweet	0;18
moto	-otho	fire	0;18
Maggie iwe	Nagi.we	Maggie You!	0;18
ndinokurova	hauyova	I'll beat you	0;18
bhasikoro	-atolo	bicycle	0;19
ndipe idzi	pe idhi	give me these	0;19
tete	tehte	auntie	0;19
nyora	nor(th)a	write	0;19

asvika	achita	she's arrived	0;19
ndinoda	-aada	I want/like	0;20
ravatora	vavatatolo	that he took	0;20
ambuya	-awua	granny	0;20
handidi	-nhidi	I don’t want	0;20
namama vangu	amamangu	with my mother	0;20
tsamba	-chamba	letter	0;21
havako	aako	he's not here	0;21
raisi	ayishi	rice	0;21
chingwa	kinga	bread	0;21
gera	-geya	cut my hair	0;21
mwana	-mana	child	0;22
bhobhi ona	bhebhi ona	bhobhi (dog) look	0;22
rori	-hoyi	lorry	0;22
chikoro	-kolo	school	0;22
adonha	hadhana	she has fallen	0;22
mbira	-mbiya	guinea pigs	0;23
shiri	-shithi	bird	0;23
havapo	-aapo	he is not here	0;24
hatidyi	atiji	we won't eat	0;24
mabhisketsi	mabhikechi	for biscuits	0;24

Appendix 2: Sibanda Data

Adult word	Child word	Gloss	Age
kurura	kujuja	undress	2;0
ɲama	nama	meat	2;0
tʃikoro	kojo	school	2;0
Bvisa	biθa	remove	2;0
sipo ʔiripi	θipo jipi	where is the soap	2;1
Tembi	temi	tembi	2;1
Pasi	paθi	ground	2;1
mija ndiɓike	mija pike	let me cook	2;1
sori mati	θoji mati	sorry mati	2;2
sija dibo	ʃija dibo	leave, dibo	2;2
ndipowo ɲama	powo nama	may I have meat	2;2
ɓaɓa ndimirire	ɓaɓa mijije	father, wait for me	2;2
Moro	mojo	hello	2;2
ndikweʃe	keʃe	should I brush?	2;3
ndipe ɓanga	ndipe ɓagŋa	give me the knife	2;3
Tenisi	teniθi	tennis	2;3
burugwa raɗona	bujuga ɗona	the plant has fallen	2;3
rumbi huja	jumbi huja	rumbi come	2;3
Mŋari	maji	God	2;4
memo ndikweɲe	memo keɲe	memo, scratch me	2;4
waguta	waguta	are you full	2;4
nditʂajire	nditsajije	can I sweep?	2;4
tikwire tese	tikije teθe	should we ride together?	2;4
tiende mama	tende mama	should we go mom?	2;5
hona maʂoʂe	hona maʃoʃe	look at the ants	2;5
ndipe tʃibage	nipe ʃibage	give me green mielies	2;5
ndipe mvura	ndipe bvuja	give me water	2;5
mira fari	mija faji	wait, fari	2;5
gwava riripi	gava jipi	where is the guava?	2;5
musikana	muθikana	it's a girl	2;6
nzɻeŋga ʔiwe	dzɻeŋga ʔiwe	dodge, you	2;6
kwaʂiba mama	kaʃiba mama	it is dark mom	2;6
tʃimŋana	ʃimana	the small child	2;6
ʔutʃarowa nababa	ʔutʃarowa naɓaɓa	father will beat you	2;7
ndoɗa tawuro ʔiro mati	ndoɗa tawujo ʔijo mati	I want that towel mati	2;7
josi ʔanogara kumusoro	josi ʔanogaja kumusojo	she stays at the top	2;7
ndoɗa kuʋata nemŋana waŋgu	ndoɗa kuʋata nemŋana waŋʔgu	I am sleeping with my baby	2;7
pitikoti jaŋgu	pitikoti jaŋgu	my petticoat	2;7

direzi raŋgu ʔiri	dijezi jaŋgu ʔiji	this is my dress	2;8
mŋana waŋgu ʔanotʃema	mana waŋgu ʔanotʃema	my baby is crying	2;8
ndaʂika ʔini	ndaʃika ini	I have arrived	2;8
ndipe spunu	ndipe sipunu	give me the spoon	2;8
hande kumagrosa	hande kumagirosa	let's go to the shops	2;8
musadonza ɓaɓa	musadonza ɓaɓa	don’t pull father	2;9
ndarukwa namama	ndarukiwa namama	I have been pleated by	2;9
makumbo ʔaŋgu ʔini	magumbo ʔaŋgu	my legs	2;9
ndakuʋadzwa nedoːo	ndakuʋadziwa nedoːo	I was hurt by the door	2;9
fransi ndipe mutʂajiro waŋgu	furansi ndipe mutsajiro waŋgu	Fransi give me my broom	2;10
tiri kumagirosa nadedi	tiri kumagirosa nadedi	we are at the grocer's shop with my dad	2;10
ʐąjita mama	ʒajita mama	it is okay mom	2;10
ʐąkanana here ɓaɓa	ʒakanana here ɓaɓa	is it beautiful?	2;10
ʔiviksi jamama	ʔivikisi jamama	its mom's vicks	2;11
hamuna tʃingwa here	hamuna tʃingwa heje	is there no bread?	2;11
kujenda newe kumba	handidi kujenda newe kumba	I don’t want to go with you home	2;11
mama ʋari kutʃikoro	mama ʋaji kutʃikojo	mom is at school	2;11
huja pano	huja kuno	come here	3;0
priska huja pano	priska huja pano	prisca come here	3;0
mama ndipowo spunu	mama ndipowo spunu	mom may I have a spoon	3;0
huku japinga mugombo	huku japinda mugomba	the chicken has gone into the pit	3;0
ʐąkakuwomera	ʒakakuwomera	it's difficult for you	3;0

Appendix 3: Mudzingwa Data

Adult word	Child word	Gloss	Age	Phase
huma	huma	bogey to frighten kids	1;3	Phase 1: The [bebe-muna] 1;3 - 1;8
nana	nana	baby	1;3	
mama	mama	mum	1;3	
sadza	tata	sadza	1;4	
sisi	titi	sister	1;4	
sija	tija	leave	1;5	
bobo	bobo	bobo	1;5	
banana	baba	banana	1;5	
je	je	response	1;5	
bebu	bebe	carry me on your back	1;5	
ndipowo	powo	may I leave?	1;7	
kosi	koko	kosi	1;7	
pipi	pipi	imitating car sound	1;7	
pera	pepe	there is nothing more	1;7	
mira	mija	wait	1;8	
mimi	mimi	Miriam 'momese'	1;8	
hamuna	muna	there is nothing	1;8	
pito	pito	whistle	1;8	
dodo	dodo	faeces/stool	1;8	
futa	puta	oil/vaseline	1;8	
fari	paji	"name" Fari	1;9	Phase 2: [majiguju - θeθi] 1;9 - 2;2
sijaji	ʃijaji	leave,let go	1;9	
miraji	mijaji	wait	1;9	
gara	gaja	gaja	1;9	
majiwe	majiwe	an exclamation	1;9	
ibvapo	bapo	get away	1,10	
sara	θaja	remain behind	1,10	
daja mama	daja	pump	1,10	
mukaka	kaka	milk	1,10	
tepi	peti	tape	1,11	
mari	mija	money	2,00	
garikuni	gajikuni	turkey	2,00	
hembe	meme	dress/shirt	2,00	
ndipowo spunu	powo punu	may I have a spoon?	2,00	
ndimirireyi	mijije	wait for me	2,00	
sefu	θefu	surf	2;1	
ndikurureji	kujeji	undress me	2;1	
hapana	hapana	there is nothing	2;2	
moro	mojo	hello	2;2	
tamba dibo	tama dibo	play, Dibo	2;2	

mugezeyi	mugeðeji	bathhim/her	2;3	**Phase 3: [ndateŋgega - ditʃa girejii] 2;3 - 3;0**
ndikweʃe	keʃe	should I brush?	2;3	
mŋari	maji	God	2;4	
basikoro	baθikojo	bicyle	2;4	
tawuro riripi	tawujo jipi	where is the towel?	2;5	
moro tambu	mojo tambu	hello Tambu	2;5	
mama ʔawuja	mama ʔawuja	mom has come	2;6	
ʔari kukreʃi	ʔaji kukeʃi	she is at creche	2;6	
hembe jakaʃiɓa	hembe jakaʃiɓa	the dress is dirty	2;7	
sketi jaŋgu	siketi jaŋgu	my skirt	2;7	
hona trakita	hona tajakita	see the tractor	2;8	
ndavura do:	ndavura do:	I have opened the door	2;8	
ʐapera mama	ʒapera mama	it is finished mom	2;9	
ʐiri kupi dedi	ʒiri kupi dedi	where are they dad?	2;9	
ʐajita mama	ʒajita mama	it is ok mom	2;10	
tiri kumagirosa nadedi	tiri kumagirosa nadedi	we are at the grocer's shop with my dad	2;10	
ʔuri kutʃeka	ʔuri kutʃeka	to cut	2;11	
ʔiviksi jamama	ʔivisiki jamama	its mom's vicks	2;11	
jananaji	jananaji	Jananaji	3;0	
huja pano	huja kuno	come here	3;0	