

**ARTICULATION AND PHONOLOGICAL IMPAIRMENTS IN THE SPEECH OF  
SECOND LANGUAGE LEARNERS IN PRIMARY SCHOOL WITH CEREBRAL  
PALSY: A CASE OF ST MARTINS DEPORRE'S PRIMARYSCHOOL, KISUMU  
COUNTY**

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degree of Doctor of Philosophy degree in English Language and Linguistics of Egerton  
University**

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## DECLARATION AND RECOMMENDATION

### Declaration

This Thesis is my original work and has not been presented for examination by any other candidate in any other university.

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## **DEDICATION**

I dedicate this work to my beloved wife Medrine, beloved sons Garang and Orisha for their understanding, their patience with an absentee father and for giving me the motivation to move on with this work and their unwavering support while pursuing my studies. May this work be an inspiration for you to seek for more knowledge in the World. To my beloved dad Francis Makuto who laid the foundation of my educational endeavours. To my dear mom Violet Makuto, you instilled the spirit of hard work and determination in me, your sweet love, care and concern to your children, steered me to this end. May the good Lord always protect and give you good health. God bless.

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## ABSTRACT

The study sought to identify and describe the articulation and phonological impairments in the speech of 6-14 year old learners of English as a second language in primary school with cerebral palsy. Further the study also established the linguistic interventions employed by the teachers to assist the learners affected by articulation and phonological impairments as a result of cerebral palsy. Optimality theory was used to account for the impairments through mapping of competence and performance vis- a-vis input and outputs as shown in the speech samples of the respondents. Further, error analysis provided the procedural methodology for analysis of the speech samples obtained from the subjects. Data was collected from 27 subjects who were purposively sampled from the school population. For purposes of understanding the levels of severity, the subjects were put into three cohorts. A qualitative design with a triangulation strategy was adopted whereby data obtained from the subjects using picture naming tasks and focus group discussion from the teachers, was put in tables and later followed with explanations. Analysis of the speech samples collected from the subjects show the presence of the articulation impairments that include omissions, substitutions, distortions and insertions. The phonological impairments were consonant deletion, cluster reduction, syllable reduction, fronting deaffrication, and stopping. Further, findings in this study show that core vocabulary and articulation therapy were the linguistic interventions employed by teachers to help remedy the impairments in the subjects. The findings of this study would be of importance and significance to three groups namely: parents, teachers and researchers. This study also offers both clinical and theoretical benefits. Clinically, data is urgently needed to inform the assessment, treatment and therapy for articulation and phonological impairments in second language learners with Cerebral Palsy. Theoretically, investigation of different varieties of English allows testing of hypothesis based on English speakers.

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## **ABBREVIATIONS AND ACRONYMS**

<b>API</b>	- Articulation/Phonological Impairment
<b>ASHA</b>	-The American Speech Language Hearing Associating
<b>CON</b>	- Constraint
<b>CP</b>	- Cerebral Palsy
<b>DAS</b>	-Developmental apraxia of speech
<b>EA</b>	- Error Analysis
<b>ESL</b>	- English as Second Language
<b>FLA</b>	-First Language Acquisition
<b>GEN</b>	-Generator
<b>IQ</b>	- Intelligence quotient
<b>L1</b>	- first language
<b>L2</b>	-second language
<b>LOI</b>	- Language of Instruction
<b>MAX</b>	- Maximise
<b>MT</b>	- Mother Tongue
<b>NINDS</b>	- The Institute of Neurological Disorders and Stroke
<b>NIDCDs</b>	- National Institute on Deafness and other Communication Disorders
<b>OT</b>	- Optimality Theory
<b>PCUR</b>	- Per cent correct underlying representation
<b>SLT</b>	- Speech Language Therapy
<b>SLI</b>	- Speech language Impairment
<b>SLLs</b>	- Second language learners
<b>SLP</b>	- Speech language pathologists
<b>SD</b>	- Standard Deviation
<b>TD</b>	- Typically developing

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background to the study

Cerebral Palsy is a medical condition that results from a brain injury that was either sustained before, during or very shortly after a child's birth. Although this condition is not progressive, that is, it does not necessarily get worse as time goes on, the characteristics and effects may change over a given period of time (Pennington, Goldbart, & Marshall, 2005). Brain injury as a result of Cerebral Palsy causes the impairment especially in muscles responsible for speech production.

Cerebral Palsy (CP) affects approximately 1-2/1000 births each year, making it one of the most common motor disorders amongst learners (Paneth & Hong, 2006). Cerebral Palsy has also been recently defined as an umbrella term that describes a movement or posture disorder that is caused by a non-progressive interference, lesion, or abnormality in the immature brain. It is a permanent, yet unchanging disorder that persists throughout one's life. (Rosenbaum et al., 2007) Because the underlying cause of CP is not curable, learners must cope with the disorder for the remainder of their life. Some characteristics of CP may include difficulties in speech and language, and communication (Pennington et al, 2005).

Speech problems associated with cerebral palsy may include articulation errors, oral motor difficulties, rate or prosody errors, and dysarthria. Dysarthria is defined as "speech disorders resulting from disturbances in musculature control over the speech mechanism due to damage of the central or peripheral nervous system. It designates problems in oral communication due to paralysis, weakness, or in coordination of the speech musculature"(Duffy, 2005). Dysarthria can greatly reduce the intelligibility of one's speech, and make it difficult for those with dysarthria to communicate with others.

A study on the characteristics of speech in learners with CP by Kiran, Üstüner Atik, Dursun, & Topbaş (2004) reported that 60.4% of learners with this condition had disturbances in intelligibility by others, and 37.5% of learners had decreased intelligibility by family members. Additionally, Kiran et al (2004) reported errors contributing to decreased intelligibility: 66.7% of learners had a disturbance of oral motor functions and phonology, 50% had difficulty with articulation, 47.9% had prosody disturbances, and 33.3% had



respiration disturbances. These impairments may be of great difficulty for learners with cerebral palsy as many learners prefer to use natural speech when possible over augmentative and alternative communication devices.

Learners with cerebral palsy may also experience negative impacts on their educational, social, and familial relationships due to their decreased intelligibility of speech. A study by Lass (1988) investigated listener perceptions of learners with articulation disorders and dysarthria. Results indicated that normal speakers were rated more favourably than Cerebral Palsy speakers on nearly all aspects of speaking tasks.

Speech impairments associated with cerebral palsy are articulation and phonological impairments that are as a result of lack of control of the musculature involved in speech production as well as imprecise movement of oral facial features. Other characteristics associated with this condition are spontaneous movement of muscles, imbalance and or shaking of the hands and feet or tight, stiff or weak muscles. Learners with Cerebral Palsy rarely initiate exchanges in conversation with familiar adults, taking a largely respondent role, while adults introduce topics and start most conversations (Pennington, 1999). They also take fewer turns in conversation than do their adult partners and often fail to reply unless obliged to do so (Light, Collier & Parnes, 1985).

Studies on second language acquisition have taken a variety of perspectives. Foreign language educators, for example, traditionally focus was on L2 acquisition among adolescents or adults in classroom settings and used correlation or small-scale quasi-experimental methods to identify good students or good teaching techniques. Foreign language educators bring the most practice-oriented perspective to L2 acquisition but may limit themselves by thinking of L2 acquisition as an outcome of L2 teaching in a classroom setting, disregarding informal or naturalistic acquisition.

Child language researchers, on the other hand, have used descriptive, longitudinal techniques with young L2 learners in naturalistic settings, often focusing on caregiver child interactions and natural school settings. Child language researchers have focused most on what factors influence learners's L1 or L2 acquisition. Sociocultural researchers study L2 learners of any age, but they tend to use qualitative methods to understand the social and cultural forces at work in any L2 learning environment. Research from a Sociocultural perspective also may examine the L2 learner's or teacher's own point of view and how issues of identity affect L2 acquisition.

Psycholinguists, by contrast, examine the mental processes involved in L2 acquisition at any age and typically use quantitative methods to study language elicited in laboratory settings, often through controlled experiments. They have been very interested in the component skills that build L2 competence and which cognitive skills may be able to transfer from L1 to L2.

In Kenya, English serves as a language of instruction in schools and is taught from the onset of schooling, making the language a significant factor in academic achievement and subsequent social mobility. The need for English and its importance in schooling in Kenya is enshrined in the National Educational Objectives, as postulated in the National Language Policy (Muthwii, 2004; Nabea, 2009). Apart from being taught as a subject in the curriculum, English is the Language of Instruction (LOI) for all other subjects (apart from Kiswahili).

The structure of primary schools is divided into two main sections and language use; In lower primary school (Standard 1-3), the use of Mother Tongue (MT) is allowed for reinforcing instruction in English-taught and examined subjects (Sure & Ogechi, 2009). However, very little if any of this phenomenon actually exists in practice as pressure arising from the need to understand English for competitive academic pursuit has led to the demise of first-language instruction in schools.

In addition, it is acknowledged that parents are increasingly showing positive attitudes towards learning English (Muthwii, 2004). In upper classes (Standard 4-8), English is the official language of instruction. All school and national examinations are taken in English. The national examinations are the sole determinants of a learner's progression in education (Nabea, 2009) and this makes understanding of English a 'life-line' for all students regardless of their age or learning level.

Studies on English as a second language have been on multilingualism. Multilingual learners speak or have knowledge of more than two languages in their communicative patterns (Miller, 2003). This situation is relatable to bilingualism where an learner has 'ability to communicate in two languages alternately' (Carter & Nunan, 2004). In Kenya, most learners join school as bilinguals, speaking their first language (Mother Tongue) and Kiswahili. In other circumstances, a learner may understand two different first languages as a result of cross-linguistic migration or intermarriage (Cook, 2001; Muthwii, 2004) and still be a Kiswahili speaker. There are also those who join school with knowledge of Kiswahili as their first language (mainly from cosmopolitan urban settings) and may have some 'level' of English learnt from the home environment. These learners are taught English and Kiswahili

at school. They can therefore be seen as both compound bilinguals (where learning of two languages takes place at school) and coordinate multi-linguals, where different languages are learnt in different settings.

Learners with special conditions such as Cerebral Palsy have been integrated into the school system so that they can also undergo learning. Although there exists literature on learners of English as a second language in primary schools, studies on the speech characteristics of learners of English as a second language with special conditions such as Cerebral Palsy remains scanty to date. Learners with Cerebral Palsy have been put in special schools which handle their special needs. Focus on these learners has been mainly multilingual or clinical taking care of their physiotherapy needs. A study on the speech characteristics of these learners would go a long way in assisting to address issues of speech and communication for the learners, so that they also are fully intergraded in their social and academic lives.

Within a school setting learners learning English as a second language affected by this condition encounter numerous challenges given that they are learning a second language and at the same time they are suffering from a condition that impedes proper articulation. The presence of articulation and phonological deficits in the speech of these learners leads to communication impairments. Although the exact prevalence of the communication disorders associated with Cerebral Palsy is not known, it has been estimated that approximately 20% of learners with this diagnosis have severe communication impairment (Pennington, et al. 2005). Many more have less severe speech and communication disorders as a consequence of their motor impairment or disorders.

Most studies of speakers with Cerebral Palsy have been conducted in English speaking countries (Leonard, 1985). There are some studies of the speech characteristics of this population in languages other than English such as Mandarin and Cantonese (Jeng, 2000; Whitehill and Ciocca, 2000). The studies have focused on adults affected by cerebral palsy, and have offered both clinical and theoretical highlights. Clinically, data are urgently needed to inform the assessment and treatment of speakers with Cerebral Palsy. Theoretically, investigation of different languages allows testing of hypotheses based on English-speakers (Leonard, 1985).

The language skills of learners with Cerebral Palsy in primary school learning English as a second language have not been studied extensively due to the heterogeneity of this group and to variation in exposure to opportunities to communicate (Bishop, Brown, & Robson, 1990). It is important to learn about the language skills of those with Cerebral Palsy in order to help parents and service providers understand how learners process information, express themselves, learn to read and write and to plan appropriate intervention programs so learners may participate fully (Sandberg & Hjelmquist, 1996). It is for this reason, that a study on Cerebral Palsy learners learning English as a second language within a Kenyan situation is important.

### **1.2 Statement of the problem**

Learners of English as a second language have articulation and phonological impairments. Relative research exists on cerebral palsy that have focused on Longitudinal growth of receptive language in children with cerebral palsy, the development of communication in children with cerebral palsy, the alignment of classification paradigms for communication abilities in children with cerebral palsy and also on articulation abilities of Learners with Cerebral Palsy .However none of the studies have looked at learners acquiring a second language and affected by cerebral palsy. None of the studies on second language acquisition in Kenya on Lexical Innovations in Child Language Acquisition, acquisition of English Syntax by Keiyo L.I speakers, acquisition of Syntax by a Four Year Old Child and the acquisition of syntactic Structures by Gikuyu Learners concerns the subjects under investigation that is learners in primary school affected by cerebral palsy, an aspect that makes the study crucial. Studies outside Kenya have examined articulation on First Language Acquisition (FLA) but have failed to tackle API in particular; a gap that is captured in the present study .Therefore, this study is timely in that it contributes to the study on articulation and phonological impairments and how this influences communication in the learners affected by cerebral palsy.

### **1.3 Assumptions**

This study was based on the following assumptions that:

1. The speech of second Language Learners with Cerebral Palsy in primary school is characterised by articulation impairments.

2. The speech of second Language Learners with Cerebral Palsy in primary school is characterised by phonological impairments.
3. Learners suffering from Cerebral Palsy in primary school have communication impairment.
4. There are recommendations or linguistic interventions that can aid learners in primary school who are diagnosed with Cerebral Palsy to become effective communicators in English

#### **1.4 Objectives of the Study**

This study sought to achieve the following objectives:

1. To determine the articulation impairments found in the speech of second Language Learners in primary school with Cerebral Palsy
2. To identify the phonological impairments in the speech of second Language Learners in primary school with Cerebral Palsy
3. To determine how articulation and phonological impairments in the speech learners with Cerebral Palsy affects communication.
4. To establish the linguistic recommendations or interventions that are suitable for learners in primary school with Cerebral Palsy

#### **1.5 Research Questions**

This study sought to answer the following questions:

1. Which articulation impairments are prevalent in the speech of learners with Cerebral Palsy in primary school
2. Which phonological impairments are found in the speech of learners with Cerebral Palsy in primary school
3. How articulation and phonological impairments in learners in primary school with Cerebral Palsy affects communication
4. What are the linguistic recommendations or interventions for learners in primary school suffering from Cerebral Palsy

## **1.6 Justification/Significance**

The study explored the Optimality Theory and error analysis and how they relate to the language acquisition process and specifically language processing for persons with cerebral palsy. The findings of this study would therefore help advance scholarship in the field of Applied Linguistics.

Communication is an important aspect of human life because it aids in expression of ideas, communication of feelings among other critical issues. Cerebral Palsy affects a person's ability to speak clearly and this is considered one of its worst symptoms.

For learners affected by this condition, depending on degree, severity and place of injury, they could be classified as non-verbal. This study therefore offers both clinical and theoretical benefits. Clinically, data is urgently needed to inform the assessment, treatment and therapy for articulation and phonological impairments in second language learners with Cerebral Palsy. Theoretically, investigation of different varieties of English allows testing of hypothesis based on English speakers (Leonard, 1998). This study further contributes towards a better characterization of the articulation and phonological errors found in Cerebral Palsy speech for second language learners, thereby helping to diagnose communication disorders and the selection criteria of phonemes and consonants for rehabilitation among Cerebral Palsy learners.

To date, our own data that represent the speech sounds characteristics for Cerebral Palsy learners in Kenya remains scanty. Previously, SLP and SLT used English phonological inventory norms as a guideline in making the diagnosis on speech of Cerebral Palsy learners. Realizing that applying other "language norms" will support cross-linguistic bias, but it is equally important to have a study on disordered speech for learners of English as a second language here in Kenya. The data from this study will be very useful not only for screening speech impairments for school going learners with Cerebral Palsy but also for the planning of speech remediation for the same learners.

In order to screen and plan for remediation for phonological and articulation disorders, normative data on the articulation abilities of learners with Cerebral Palsy in Kenya is needed- This data is useful as a referral for estimating approximately how 'deviate', 'delayed' or 'severe' the learners are as compared to normal learners. It is also useful when planning for the speech intervention or therapy. Previously, SLP refer to English phonological inventory chart to help them in making diagnosis, since information on second language learners with

Cerebral Palsy is scanty. Realizing that every variety of language has its own developing pattern, and applying other language hypothesis will highly support cross-linguistic bias, the study on second learners with Cerebral Palsy is prudent.

Finally findings from this study will help to come up with recommendations that would aid in correction and treatment of the articulation and phonological impairments in learners with this condition therefore further improve on communication of learners affected by Cerebral Palsy.

### **1.7 Scope and Limitations of the study**

This study focused on articulation and phonological impairments characteristic of the speech of second language learners in primary school age 6-14 years, diagnosed with Cerebral Palsy. It was limited on speech disorders which were a result of damage to the part of the brain (Neurogenic) associated with speech production. This study focused mainly on the articulation of consonants in terms of the place, manner and also voicing. The study did not examine the articulation of vowels in terms of advancement that is front, centre or back as well as vowel height that is high, mid or low. This study did not delve into the speech disorders that are as a result of language delay and hearing loss. The study examined the speech of learners with Cerebral Palsy in a classroom setting as they interact with the teacher. Other forms of informal interactions such as exchanges between pupils outside the classroom setting were not within the confines of this study.

## 1.8 Definition of terms

**Language-** The system of human communication by means of sounds or their written representations combine to form larger units such as morphemes, words and sentences.

**Speech** is the spoken production of language and the process through which sounds are produced. Several parts of the body work together to produce sound waves, and this motor production of speech is called articulation. The parts of the vocal tract involved with speech include the lips, tongue, teeth, throat, vocal folds, and lungs.

**Speech disorders** refer to difficulties in producing speech sounds or problems with voice quality. They are characterized by an interruption in the flow or rhythm of speech, such as stuttering, which is also called dysfluency. Speech disorders that affect the way sounds are formed are called articulation or phonological disorders.

**Cerebral** refers to the cerebrum, which is the affected area of the brain (although the disorder most likely involves connections between the cortex and other parts of the brain such as the cerebellum)

**Palsy** refers to the disorder of uncontrolled muscle movement such as shaking.

**Cerebral Palsy** a condition that is caused by damage to the motor control centres of the developing brain and can occur during pregnancy, during childbirth or after birth up to about age three.

**Assessment** A process that typically involves screening a child's communication skills in a general way and then forming a hypothesis on the nature of apparent difficulties

**Impairment** It refers to the inability to produce speech sounds. It may range from being mild to severe and it may include an articulation and phonological disorder, characterised by omissions and distortions.

**Parse** means that a segment in the input surfaces in the output representation

**Phonology** is a study of the acquisition of speech sounds or phonemes, the elements and principles that determine the patterns for use of those sounds

Source: International Encyclopaedia of Linguistics



## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 An overview

This section is divided into two: the first section examines literature on the speech of learners with Cerebral Palsy and also second language acquisition. The second section contains the contemporary linguistic framework known as Optimality Theory which accounts for the articulation and phonological impairments prevalent in the speech of learners with Cerebral Palsy.

#### 2.2 Cerebral Palsy and Speech

Cerebral Palsy (CP) affects approximately 1-2/1000 births each year, making it one of the most common motor disorders amongst learners (Paneth & Hong, 2006). Cerebral Palsy has been defined as an umbrella term that describes a movement or posture disorder that is caused by a non-progressive interference, lesion, or abnormality in the immature brain. It is a permanent, yet unchanging disorder that persists throughout one's life (Rosenbaum, Paneth, Leviton, Goldstein & Bax, 2007). Because the underlying cause of CP is not curable, learners must cope with the disorder for the remainder of their life. Some characteristics of CP may include difficulties in speech, language and communication disorders. (Pennington et al, 2005).

Speech disorders are as a result of disturbances in musculature control over the speech mechanism due to damage of the central or peripheral nervous system. It designates problems in oral communication due to paralysis, weakness, or in coordination of the speech musculature“(Duffy, 2005). This condition can greatly reduce the intelligibility of one's speech, and make it difficult for those with Cerebral Palsy to communicate with others.

A study on the characteristics of speech in learners with Cerebral Palsy by Kiran et al (2004) reported that 60.4% of learners with Cerebral Palsy had disturbances in intelligibility by others, and 37.5% of learners had decreased intelligibility by family members. Additionally, Kiran et al. (2004) reported errors contributing to decreased intelligibility: 66.7% of learners had a disturbance of oral motor functions and phonology, 50% had difficulty with articulation, 47.9% had prosody disturbances, and 33.3% had respiration disturbances. These impairments may be of great difficulty for learners with Cerebral Palsy within a learning

setup like in a school. Learners with Cerebral Palsy also experience negative impacts on their educational, social, and familial relationships due to their decreased intelligibility of speech.

A study by Lass, Rucello, and Lakawicz (1988) investigated listener perceptions of learners with articulation disorders and dysarthria secondary to either Cerebral Palsy or other developmental disorders. Results indicated that normal speakers were rated more favourably than Cerebral Palsy speakers on nearly all aspects of speaking tasks. Traditionally, speech-language pathologists have focused on helping learners with cerebral palsy to maximize their communication skills. Therapy concentrating on speech production and improved intelligibility may address laryngeal, velopharyngeal, respiratory and articulatory in competencies. Additionally, Cerebral Palsy learners have problems in verbal communication.

In a study done by Darly, et al (1996) on the speech of people with Cerebral Palsy, it was noted that the learners had problems in oral communication due to paralysis and weakness in coordination of the muscles involved in speech production. Further according to the American Speech Language and Hearing Association (2003) the speech of persons with Cerebral Palsy is characterised primarily by sound distortions and omissions which are consistent across speaking tasks. Consonants are affected more than vowels and are imprecise with similar production impairments in all production (ASHA, 2003, P 40). Worth noting about Cerebral palsy as a condition is its worst symptom which is spacity.

Spacity affects the control of muscles especially the muscles involved in speech. Speech is a motoric activity that involves the coming together of at least two articulators in order for sounds to be produced. Cerebral palsy as a condition leads to lack of control of the musculature involved in speech production as well as imprecise movement of oral facial features. Although learners with Cerebral Palsy have speech and language, and/or communication disorders (Pennington et al, 2005). It is worth noting that there are those who are able to speak albeit impairments in all production (ASHA, 2003, P 40).Intelligibility is the main communication problem for learners with Cerebral Palsy (Kiran, et al (2004)) The resultant of this is articulation and phonological impairment in the speech of learners faced with this condition which is the concerns of this study.

### **2.3 Articulation and phonological impairments**

The American Speech Language and Hearing Association define an articulation disorder/impairment as the atypical production of speech sounds. According to this association

articulation impairment is characterised by the omission, distortion, substitution, addition and or incorrect sequencing of speech sounds.

Bowen, (2001) examined articulation impairment due to physical causes such as Cerebral Palsy, cleft palate and hearing impairment. From this study it was noted that the speech of respondents under study were characterised primarily by distortions and omissions which are consistent across speaking tasks. Consonants are affected more than vowels and they are imprecise with similar production in all positions. This study offers insight into the speech characteristics of learners with Cerebral Palsy especially on the articulation accuracy of the consonants, the study however does not delve into phonological abilities of the learners in that study.

Bernthal & Bankson, et al (1993)note that a phonological impairment not only affects a speaker's production but also the mental representation of speech sounds of the target language. Specifically, a phonological disorder may reflect an inability to articulate speech sounds with the communication difficulty involving a motoric component. Impairments of this type have been described as phonetic in nature; that is the difficulty lies in how the sounds are produced (Dinnsen, 1984; Elbert, 1991). Further, a phonological disorder may also affect the way in which speech sound information is stored and represented in the mental lexicon or is accessed and retrieved cognitively (Bernhardt, 1992). In this case communication difficulty may have a linguistic or cognitive basis. Disorders of this type may be termed as phonemic because the difficulties can involve the way in which sounds are used to signal meaning differences in words (Dinnsen, 1984; Elbert, 1992)

Further literature on phonological impairments shows a broad impact on both a child's articulation (i.e performance) and internalized knowledge (i.e competence) of the sound system of the target language (Gierut, 1990; Kamhi, 2007). For many learners with phonological impairments, receptive and language abilities may not be age specific (Hoffman, 1992). However, semantic, syntactic and pragmatic disorders of language have frequently been observed in association with phonological impairments (Camarata, 2010; Campbell & Shriberg, 2007).

Learners who have been diagnosed with Cerebral Palsy (Blakeley & Brockman, 1995; Estrem & Broen, 1989) exhibit organically based phonological impairments. Certain phonological disorders have an organic basis (Cermak & Ward, 1986; Christenen & Hanson,

1981) and these most directly affect the articulatory or motor aspects of speech sound production. Currently studies are being conducted to identify remedy for phonological impairments (Dyson & Lombardino, 1989).

According to the American Speech Language and Hearing Association, Cognitively or linguistically based sound production errors are termed as phonological disorders and they result from impairments in the organization of phonemes and their application in speech. It is noted that learners with phonological disorders may be able to produce a sound correctly but not use it in the appropriate context. Further a child may display a reduced phonemic inventory (ASHA, 2003). Contrary to the fact that phonological disorders are considered phonemic in nature because of the sound errors, they are not due to inadequate production but impaired use in specific contexts.

In a study by Benthall and Bankson, (1998) it is noted that whereas errors in sound production are classified as motorically based, disorders that are cognitive based are sometimes referred to as impairments of the phonological processes. For phonological impairments sounds may be well articulated, but inappropriate for the context. The above studies show the relationship between Cerebral Palsy and impairments associated with this condition. Further studies on Cerebral Palsy show a direct relationship that the impairments have on communication.

#### **2.4 Communication Impairment**

Cerebral palsy is a non-progressive motor disorder due to a defect or lesion in the immature brain which affects 1 – 2.5 per cent per 1,000. Cerebral Palsy affects an learners's ability to control muscular movements (Cogher et al, 1992; Crickmay, 1966). Of the learners diagnosed with CP, 20 percent will present with severe communication impairment and are non-verbal (Strand, 1995). The most common resulting speech disorder in CP is dysarthria which is caused by difficulties with oro-muscular control due to impairment of the motor processes which are involved in the delivery of speech (Darley, Aronson & Brown, 1975).

For learners who have CP the resulting dysarthric features can include low pitch, hypernasality, breathy voice, pitch breaks, excess and equal stress and problems with articulation (Kent, 2000; Pennington et al, 2006; Workinger & Kent, 1991). The child may also produce speech which "is explosive and punctuated by long pauses". Workinger (2005) goes further to state that learners with CP have fine and gross motor difficulties and will therefore not have a significant memory of movement patterns when trying to produce speech.

Some learners with CP may also have dyspraxic speech. This is where they appear to grope for the appropriate movements of the mouth. They are unable to achieve the target sound or oral motor movements and sequence them to make words (Pennington, 2003; Van Riper & Erickson, 1996). There has been some discussion regarding the ability for a child with CP and their ability to use the tongue tip. This would therefore impact on sounds such as [t] and [d]. Successful treatment provided has included teaching the child to raise the tongue to the upper-gum ridge to produce these sounds (Van Riper & Erickson, 1996).

Learners with severe articulation and phonological impairment have a high probability of failed communication interaction. The difficulty in executing and coordinating the speech mechanism results in communication impairments (Marquardt and Sussman, 1991). According to the national institute on deafness and other communication disorders, articulation and phonological impairments (henceforth API) are among the most prevalent communicative disabilities observed in learners with Cerebral Palsy. For 80% of these learners the impairment is so severe that to require clinical treatment (NIDCD, 1994). Often times learners with API require other types of remedial services, with 50% to 70% exhibiting general academic difficulty through grade.

A study by Bishop & Freeman, (1995) shows there is also an observed relationship between API and subsequent reading, writing and spelling difficulties. Of greater significance is the fact that API can have consequences that can potentially affect an learners throughout the lifespan (Shriberg, 1982). In particular retrospective studies have shown that learners diagnosed and treated for API have continued to have difficulties in retrieval, manipulation and comprehension of linguistic information (Felsenfeld et al, 1992).

Crowe Hall, (1991) observes that learners with communication impairments as a result of Cerebral Palsy might select jobs that require minimal communication. The learners have trouble producing speech sounds and also difficulty in processing information related to language and to the sound system in particular. Further studies show that learners with API may be disadvantaged in situations that require the comprehension and production of language.

Silja Pirila et al. (2007) examined motor speech and language skills in learners with CP. The aim of the study was to investigate associations between the severity of motor limitations, cognitive difficulties, and language and motor speech problems in learners with Cerebral

Palsy. For this purpose, 36 learners (age range 1 year 10 months to 9 years 0 months) with CP due to premature birth and white-matter damage participated in the study. 62 % had an intelligence level above 70. One-half of this group exhibited motor speech problems. Learners with an intelligence level below 70 (38%) showed problems in motor speech skills as well as in verbal expressive and comprehensive skills. Although available research shows a correlation between intelligence level and prevalence of motor speech skills, an unexpected finding of the current investigation indicates an improvement in the verbal and communicative skills of the learners with Cerebral Palsy.

Research into the speech of English speakers by Leonard, (1998) examines the speech of eight English speaking learners with phonological impairments. In this study guided by Government phonology(GP), the phonologically impaired speech of the eight English speaking learners is investigated for presence of three types of clusters namely onset clusters, initial /s/ clusters and (non initial) coda onset sequences- with a special interest in the implicational relationship between initial /s/ clusters and coda onset sequences. This study reveals the GP framework can be used to examine the presence of consonant clusters. Three parameters [+/- BO], [+/-BR] and [+/-MEN] were used to account for the presence of onset clusters, initial /s/ clusters and coda onset sequences by learners with phonological/ articulation disorders. This study has theoretical significance presenting a new perspective on the presence of clusters in speech of phonologically impaired learners. The findings of this study could allow speech therapists to locate the specific abilities and needs of learners with phonological impairments for the treatment of onset clusters. The study on English speakers provides insights into the testing of hypothesis on other languages for learners with Cerebral Palsy.

In a study carried out by Svraka (2005) on the speech characteristics of Bosnian learners with Cerebral Palsy, it was noted that all the 32 respondents were characterised by motoric dysfunctioning which was accompanied by speech impairments as a result of poor respiratory control, muscular weakness and soft palate dysfunction. In this study, the inability to control muscles involved in speech production resulted in phonologically impaired speech characterised by problems with distinctive sounds in spoken language. The speech sounds (phonemes) were either not produced, not produced correctly, or were mispronounced.

Svraka (2005) further did a study on the communication abilities of learners with spastic CP. The aim of the study was concerning types of spastic CP of learners and adolescents with

spastic CP, to determine the existence of speech and communication impairment. From this study, of the 75 learners who took part in the study, 69.3% were found with speech impairment and 30.7% did not have it thus confounding the fact that learners with CP has communication impairment in speech.

Manochipoinig, et al (2008) assessed the speech characteristics of 14 Thai learners affected by Cerebral Palsy. Each speaker was tested for speech correctness of all Thai phonemes. Findings from this study show that from the error patterns that were analysed, vowel and tonal characteristics were the most intact characteristics, while speech reduction of the cluster consonant was the most impaired feature. Both initial and final consonants were frequently substituted, followed by omissions and distortions thereby affecting communication.

Cerebral Palsied learners lack articulatory precision (Sawney and Wheeler 1999). From this study it was noted that the respondents exhibited imprecise articulation of word initial consonants which involved /n/, /s/, /z/, /d/, /t/ sounds. It was further noted that some respondents incorrectly made group of sounds, usually substituting earlier developing sounds for later developing sounds and consistently omitting sounds. In this study, the learners with phonological deficits substituted / t/ with /k/ and /d/ with /g/. They frequently leave out the sound /s/ so stamp becomes tamp and snake, become naked. Phonological deficits seriously affect communication. It is against this background that this study seeks to identify, characterise and document API for learners with cerebral palsy within a second language acquisition setting.

Platt et al, (1980) carried out a phonemic analysis of the articulation errors of 40 males, aged 17–55 years, were analysed using a confusion matrix paradigm. The subjects had a diagnosis of congenital cerebral palsy, and adequate intelligence, hearing, and ability to perform the speech task. Phonetic transcriptions were made of single-word utterances which contained 49 selected phonemes: 22 word-initial consonants, 18 word-final consonants and nine vowels. Errors of substitution, omission and distortion were categorized on confusion matrices such that patterns could be observed.

In this study it was found that within-manner errors (place or voicing errors or both) exceeded between-manner errors by a substantial amount, more so on final consonants. The predominant within-manner errors occurred on fricative phonemes for both initial and final positions. Affricate within-manner errors, all of devoicing, were also frequent in final

position. The predominant between-manner initial position errors involved liquid-to-glide and affricate-to-stop changes, and for final position, affricate-to-fricative. Phoneme omission occurred three times more frequently on final than on initial consonants.

The error data of learners were found to correspond with the identified overall group patterns. Those with markedly reduced speech intelligibility demonstrated the same patterns of error as the overall group. The implication of this study to the current study regards selection of sample size for the words to be used in the language task. Secondly it provides an insight into the nature of impairments in for English native speakers thereby providing a basis for examining the impairments in second language speakers acquiring English with a learning setting.

Parkes, (2010) carried out a register study on oromotor dysfunction and communication impairments in learners with Cerebral Palsy: With an aim to report the prevalence, clinical associations, and trends over time of oromotor dysfunction and communication impairments in learners with Cerebral Palsy (CP). He used multiple sources of ascertainment were used and learners followed up with a standardized assessment including motor speech problems, swallowing/chewing difficulties, excessive drooling, and communication impairments at age 6 years.

The study had a total of 1357 learners born between 1980 and 2001 were studied (781 males, 576 females; median age 5years 11months, interquartile range 3-9years; unilateral spastic CP, n=447; bilateral spastic CP, n=496; other, n=112; Gross Motor Function Classification System [GMFCS] level: I, 181; II, 563; III, 123; IV, 82; V, 276). Of those with 'early-onset' CP (n=1268), 36% had motor speech problems, 21% had swallowing/chewing difficulties, 22% had excessive drooling, and 42% had communication impairments (excluding articulation defects). All impairments were significantly related to poorer gross motor function and intellectual impairment. In addition, motor speech problems were related to clinical subtype; swallowing/chewing problems and communication impairments to early mortality; and communication impairments to the presence of seizures. Of those with CP in GMFCS levels IV to V, a significant proportion showed a decline in the rate of motor speech impairment ( $p=0.008$ ) and excessive drooling ( $p=0.009$ ) over time. The result from this study shows that these impairments are common in learners with CP and are associated with poorer gross motor function and intellectual impairment.



Further, Platt et al, (1980) did a study on the speech intelligibility and articulatory impairment of 32 spastic and 18 athetoid males, aged 17–55. Selection of the subjects was based on a definite diagnosis of Cerebral Palsy, and adequate intelligence, hearing, and ability to perform the required tasks. Two estimates of speech intelligibility were obtained from native listeners: single words correctly recognized and prose intelligibility rating and per cent correct articulation of selected phonemes were employed as indices of articulatory impairment. The 50 subjects were, on average, judged to be 50% intelligible on both intelligibility estimates. Group mean rate was 2.9 syllables per second and 78% of phonemes were transcribed as correctly articulated. The mean scores of the spastic subjects were superior to the athetoids on all speech measures, significantly so for single-word intelligibility and DDK rate even when group inequalities for physical disability and I.Q. were adjusted. In this sample, spastics were less physically disabled and had lower I.Q.'s than athetoids.

Specific phonemic features characteristic of the dysarthria in Cerebral-Palsied subjects were as follows: (1) anterior lingual place inaccuracy; (2) reduced precision of fricative and affricate manners; and (3) inability to achieve the extreme positions in the vowel articulatory space. A comparison of these results with those reported for learners with Cerebral Palsy suggests that the consonantal place and manner problems are fairly stable features of cerebral palsy dysarthria. Findings from this study further demonstrate that learners with Cerebral Palsy have intelligibility problems. It further shows that Cerebral Palsy learners have problems with articulation accuracy especially on consonants in terms of place, manner and voicing. Although the current study does not distinguish among the types of Cerebral Palsy, of relevance to the current study are the statistics on intelligibility scores and articulation impairments covering features of manner and place of articulation for consonants.

Hustad, et al (2008 ) carried out a study on the Intelligibility of 4-Year-Old Learners With and Without Cerebral Palsy. The purpose of the study was to examine speech intelligibility in typically developing (TD) learners and 3 groups of learners with Cerebral Palsy (CP) who were classified into speech/language profile groups following Hustad, Gorton, and Lee (2010). The subjects were given questions that addressed differences in transcription intelligibility scores among the groups, the effects of utterance length on intelligibility, the relationship between ordinal ratings of intelligibility and orthographic transcription intelligibility scores, and the difference between parent and native listener ordinal ratings. Speech samples varying in length from 1 to 7 words were elicited from 23 learners with

Cerebral Palsy ( $M_{\text{age}} = 54.3$  months) and 20 TD learners ( $M_{\text{age}} = 55.1$  months). Two hundred fifteen native listeners made orthographic transcriptions and ordinal ratings of intelligibility. Parent ordinal ratings of intelligibility were obtained from a previous study (Hustad et al., 2010). The results of this study were Intelligibility varied with speech/language profile group and utterance length, with different patterns observed by profile group. Ratings of intelligibility by parents and native listeners did not differ, and both were highly correlated with transcription intelligibility scores. In conclusion, Intelligibility was reduced for all groups of learners with CP relative to TD learners, suggesting the importance of speech-language intervention and the need for research investigating variables associated with changes in intelligibility in learners with Cerebral Palsy.

Hustad (2010) carried out a study on the classification of Speech and Language Profiles in four -Year-Old Learners with Cerebral Palsy. Methodology in this study involved speech and language assessment data collected in a laboratory setting from 34 learners with Cerebral Palsy (CP; 18 male, 16 female) with a mean age of 54 months ( $SD = 1.8$ ). Measures of interest were vowel area, speech rate, language comprehension scores, and speech intelligibility ratings.

Results from this study showed that 3 functions accounted for 100% of the variance among profile groups, with speech variables accounting for 93% of the variance. Classification agreement varied from 74% to 97% based on 4 different classification paradigms. The conclusions from this study provide preliminary support for the classification of speech and language abilities of learners with CP into 4 initial profile groups. However, one of the recommendations of the study is that further research is necessary to validate the full classification system.

Forrest, (1999) carried out a study on feature Analysis of Segmental Errors in Learners with Phonological Disorders. From this study it is observed that there has been a longstanding controversy about the existence, nature, and differentiation of developmental apraxia of speech (DAS), leading to numerous investigations of characteristics that define this articulatory disorder. An analysis of substitutions relative to target sounds led Thoonen, Maassen, Gabreëls, and Schreuder (1994) to conclude that learners with DAS show a pattern of feature retention in their error productions that contrasted with that of learners with normal articulation. This pattern, in which place of articulation was retained in the substituted sound

less frequently than manner of production or voicing, was considered by Thoonen et al. (1994) to be of diagnostic significance.

Of relevance to the current research is a re-examination of this claim by comparing the retention patterns obtained by Thoonen et al. (1994) for learners suspected of having DAS to patterns for learners suspected of having a phonological disorder. An examination of substitutions used by 20 learners who were diagnosed with and treated for phonological disorders demonstrated the same pattern of feature retention that was described for learners with DAS. The results of this study showed that voicing is maintained most frequently; manner of production is the next most retained feature; and place of articulation is the feature that is retained least often when a substitute is used for a sound that isn't produced correctly.

In a second analysis, this pattern of feature retention was compared to learners' phonological knowledge as indexed by percent correct underlying representation (PCUR). Contrary to the findings of Thoonen et al. (1994), however, the present work found an inverse relationship between retention of place and phonological knowledge. Learners with greater phonological knowledge retained place less often than learners with more limited phonetic inventories. These patterns of feature retention may be representative of specific development sequences that occur during phonological acquisition.

As shown from the above studies, learners with Cerebral Palsy have communication problems that include error patterns such as substitution of phonemes in the speech of learners with Cerebral Palsy Thoonen et al. (1994). Speech intelligibility is also a problem associated with this condition Hustad, et al (2012). Further the studies have demonstrated that learners with Cerebral Palsy lack articulation precision and accuracy in consonants as compared to vowels. Further Platt, et al (1980). These studies have been done in English, Cantonese and Mandarin. Interestingly studies on English with a second language learning situation here in Kenya remain scanty. It is on this note that this study comes in to address this gap and to document and characterise the articulation and phonological impairments in the speech of second language learners with Cerebral Palsy.

## **2.5 Second language acquisition**

Fromkin (2011) says that Language acquisition is the process by which humans get the capacity to perceive, produce and use words to understand and communicate. This process entails mastery of the full range of grammatical and communicative competence.

According to Ellis (1994), study of a language, which learners give an output in all their development stages, is the beginning point of L2 acquisition. The acquisition process identification occurs in several ways, which include the study of the learners' pragmatic features, errors portrayed, variability, and various types of development patterns. The errors identified are classified as developmental errors (errors associated with L1 acquisition), interference errors (errors reflecting mode of L1), and unique errors (errors that do not fall in either interference, or developmental categories). Learners learning English as a second language fall in the category of unique errors that is errors that are neither due to interference nor developmental.

According to Ellis (1994), L2 acquisition has a wide variety of meanings. It is viewed as any form of language that differs from the first language. L2 is often perceived as a foreign language. Muthwii and Kioko (2004) argue that, despite the fact that, public domain of Kenyan language has a historical background setting, a lot of language use has attributes to interaction of social setting, ethnicity factors, and developed attitude of citizens with regard to languages. There are three challenges that have faced language in education since the start of the colonial era. The first challenge is that language is to act as a medium of instruction.

The second challenge concerns the level of education system at which the second language is introduced, and finally who the qualified teachers are, to teach the language. With the above in mind it is important to find out whether ethnicity or the region where one grows up in and the first language one uses in social circles has any positive or negative effect on learning English as a second language. The above reasons apply for typical learners learning a second language in school setting. For learners with cerebral palsy, their problems are compounded due to the condition they that they are in.

## **2.6 Second language studies in Kenya**

The need for English and its importance in schooling in Kenya is enshrined in the National Educational Objectives, as postulated in the National Language Policy (Muthwii, 2004; Nabea, 2009). Apart from being taught as a subject in the curriculum, English is the Language of Instruction (LOI) for all other subjects (apart from Kiswahili). Kiswahili is the country's national language and is taught alongside English as a mandatory subject. The structure of primary schools is divided into two main sections and language use is 'on paper', structured in favour of multilingualism. In lower primary school (Standard 1-3), the use of Mother Tongue (MT) is allowed for reinforcing instruction in English-taught and examined

subjects (Sure & Ogechi, 2009). However, very little if any of this phenomenon actually exists in practice as pressure arising from the need to understand English for competitive academic pursuit has led to the demise of first-language instruction in schools. In addition, it is acknowledged that parents are increasingly showing positive attitudes towards learning English (Kioko & Muthwii, 2004).

In upper classes (Standard 4-8), English is the official language of instruction. All school and national examinations are taken in English. The national examinations are the sole determinants of a learner's progression in education (Nabea, 2009) and this makes understanding of English a 'life-line' for all students regardless of their age, learning level or the condition that they are suffering from.

Most students in Kenya have many problems in perceiving the L2 Languages. Bartoo (2004) investigated on the acquisition of English syntax by Keiyo L1 speakers. In her study, she looked at the syntactic errors that result from L1 transfer in the process of acquiring English as a L2 by Keiyo speakers of English. She looked at the effects of the errors on the performance of the pupils, and whether teaching played a role in the eliminating the errors. She found out that, Keiyo L1 speakers made omissions, misordering, and misformation errors in the process of acquiring English. These errors, she says, inhibit the performance of learners. However, teaching plays an important role in the elimination of the errors.

Macharia (2013) examines the phonological basis of misspellings in the compositions of high school students of Gikuyu learning English as a second language. The findings lend credence to the hypotheses that the first language phonology and the mispronunciation of words in the target language influence orthography in English. In the eight categories of the major classification of misspellings discussed in this paper, it may be concluded that there are problems which are caused by the influence of the phonology of Kikuyu as the first language and the pronunciation of words in English.

## **2.7 Second language learners affected by Cerebral palsy**

Most of the studies done on the speech of Cerebral Palsy learners have focused on the speech of the learners. Studies have demonstrated that learners suffering from cerebral palsy have intelligibility problems (Kiran, 2004) and problems with oral communication (Darley, 1969). Further learners affected by this condition lack articulation precision and accuracy whereby consonants are affected more than vowels. (Bowen, 2001). It is also noted that learners

diagnosed with cerebral palsy exhibit phonological impairments which directly affect articulatory or motor aspects of speech production.

Notably most of the studies have been done on English speakers (Darley, 1969, Pennington, 2007). Studies on cerebral palsy learners learning English as a second language have also been carried out in Cantonese, mandarin Bosnian learners (Svraka,2005) Thai (Manochipoinig,2008).

The studies demonstrate impairments in substitution, omission and insertions. Many studies have been done on second language learners of English. The studies have focused on how the L1 of the learners has influenced or interfered with the acquisition of English as a second language. Interestingly, a study on second language learners of cerebral palsy and their speech impairments seems to be scanty. It is within these confines that this study profoundly seeks to establish and address the gap.

## **2.8 Theoretical Framework**

In this section a contemporary linguistic framework known as Optimality Theory is described. The basic assumptions of this theory are a constraint based model of grammar. This theory is applied in descriptions of learners's common error patterns and it will be examined vis a vis its relevance to the characterisation and documentation of articulation and phonological impairments in the speech of second language learners with Cerebral Palsy in this study.

### **2.8.1 An Overview**

Among the earliest linguistic theories with direct application to speech and language pathology and specifically articulation and phonological impairments, were American Structuralism (Hockett, 1955) and the Prague school (Jakobson, Fant, & Halle, 1965). American Structuralists were primarily credited with charting a precise description of the articulatory characteristics of speech sounds of languages of the world, which ultimately led to the development of the International Phonetic Alphabet

Like American structuralism, members of the Prague school concentrated on the patterns among speech sounds but at more fine grained and universal levels. This linguistic movement further delineated the properties of speech sounds identifying smaller sub constituents called distinctive features. (Chomsky and Halle, 1968). One new insight was the distinction between phonemic inventories or sounds articulated in a language or sounds used to meaning

differences among morphemes. This in turn led to the discovery of language universals (Greenberg, 1978). For speech pathology an important outgrowth was the extension of distinctive features and language universals to the acquisition of language (Jakobson, 1968).

The benefits of language universals and complexity of the treatment target have been widely documented for a host of sound patterns and a diverse set of populations including for example phonologically disordered apraxic, aphasic, hearing impaired, cognitively impaired, bilingual and second language learners (Gierut, 2001). Thus linguistic theory led to an underlying principle of complexity that seems to be central to the planning of intervention independent of the speech disorder type.

Perhaps the most influential linguistic theories that have made contribution to the study of phonological disorders were the two schools of generative phonology, Natural (Stampe, 1969) and Standard (Chomsky and Halle, 1968). Generative phonology as whole aimed to establish a systematic mapping between a speaker's implicit knowledge of the sound system (competence) and his or her explicit use of the sound system (performance). To achieve this mapping, the theory focused on the systemic application of phonological rules or processes. Within Natural Phonological, phonological rules are thought to have a physical basis either in articulation or perception. In this model, speakers simplify their productions via phonological rules sounds are easy to articulate and salient to perceive.

Standard Generative Phonology departs from natural phonology in its scope. Specifically; the mapping of a speaker's competence and performance is achieved in more than just one way (Dinnsen, 1984). Its basic tenets are static rules of the sound system where only certain sounds and sound systems are allowed in the grammar. Then there are dynamic rules which change the phonetic properties of a speaker's productions in well-defined contexts. Application of generative phonology found that learners with phonological/ articulation disorders have multifaceted problems associated with incorrect (non-adult like) representation of lexical terms and/or phonological rules.(Gierut, Elbert & Dinnsen, 1987).

Many linguistic theories have a fundamental assumption that every speaker has an idealised mental representation of the phonological properties of each word in his or her lexicon, as illustrated for the word "Glove" in Table 1.

**Table 1: Phonological properties of Glove**

Mental representation	/g <sup>l</sup> v/
Cluster reduction	g <sup>v</sup>
Fronting	d <sup>v</sup>
Stopping	d <sup>b</sup>
Phonetic output	[d <sup>b</sup> ]

In the production of “Glove” a speaker’s phonetic output may not match the internal mental representation because of reasons such as being affected by a medical condition such as CP, speech delay and other developmental disorders.

In the study of articulation/ phonological impairments we take account of these likely mismatches among learners diagnosed with CP with emphasis on mental representation and sequential applications of phonological rules in derivational mapping of competence to performance. The Optimality Theory (Prince and Smolensky, 2002) however signals a distinct paradigmatic shift in that it challenges this long standing conceptualization.

### **2.8.2 Optimality Theory**

Optimality Theory henceforth OT was a natural outgrowth of computational models that were being developed at the time as analogs of cognitive processing (Prince and Smolensky, 1997, 2002). In this way OT stands apart from prior theories in that it brings the formal structure of language with its function of language processing and communication. Linguistics is thereby integrated with psycholinguistics to yield a unified perspective of language.

OT is examined as a viable account of phonological acquisition in its ability to capture learners’ error patterns, inter and intra-child variability and longitudinal change in learners’ productions. OT also helps in the diagnosis and treatment of API as a means of empirical testing (and potentially falsifying) the theory.

### **2.8.3 Basic tenets of OT**

One major goal in the field of phonology is to compare speaker’s competence to their performance. That is phonologists explore what speakers know about their language and compare that to what the speakers actually say. The discrepancy between competence and



performance is often dramatic and the goal of phonological theory is to provide an explanation for such discrepancies.

It is often assumed that a speaker of a given language has some mental representation for a given word or sound, but sometimes that word has a very different surface representation. In order to account for this mapping of competence to performance studies have postulated derivations (Chomsky and Halle, 1968: Goldsmith, 1990). Whereas previous frameworks have been largely derivational in nature, OT assumes a different organization of the grammar. Mental and surface representations are still assumed to exist but they are referred to as input and output representation. In order to account for the API, the theory has three basic mechanisms that comprise the grammar, the Generator (GEN), Constraint (CON) and Evaluator (EVAL).

Each has a different function, but they work in tandem through parallel and distributed processing characteristic of connectionist models. GEN supplies all of the outputs that are permissible in any grammar of any language. For example, for the word “cat” outputs would include forms similar to input such as [kæt], [kæ] and [tæ] as well as less similar forms such as [bob] and [mu]. CON provides a library of constraints which limit and influence the myriad of possible outputs. The library of constraints in CON is shared universally by all languages. Thus all speakers have the same information available in GEN and CON. EVAL on the other hand is child specific. It provides ranking of the constraints in CON by importance and relevance to the sound system of the particular language at hand.

The role of EVAL is to compare the outputs of GEN against the universal set of constraints of CON. On the basis of this comparison EVAL then selects an “optimal” output that best matches a child’s intention. An “optimal output” is defined as the output that violates the fewest number of high ranked constraints in the grammar and consequently it emerges as the winning production. These constraints are ranked in a language specific order. This allows for each language to have its own ranking thereby permitting variation in the types of grammars that are observed. One crucial aspect of this framework is that constraints are violable. In other words it is possible for a grammar to choose an optimal candidate that does not satisfy every constraint. In fact, every possible output form will violate some constraint of the grammar.

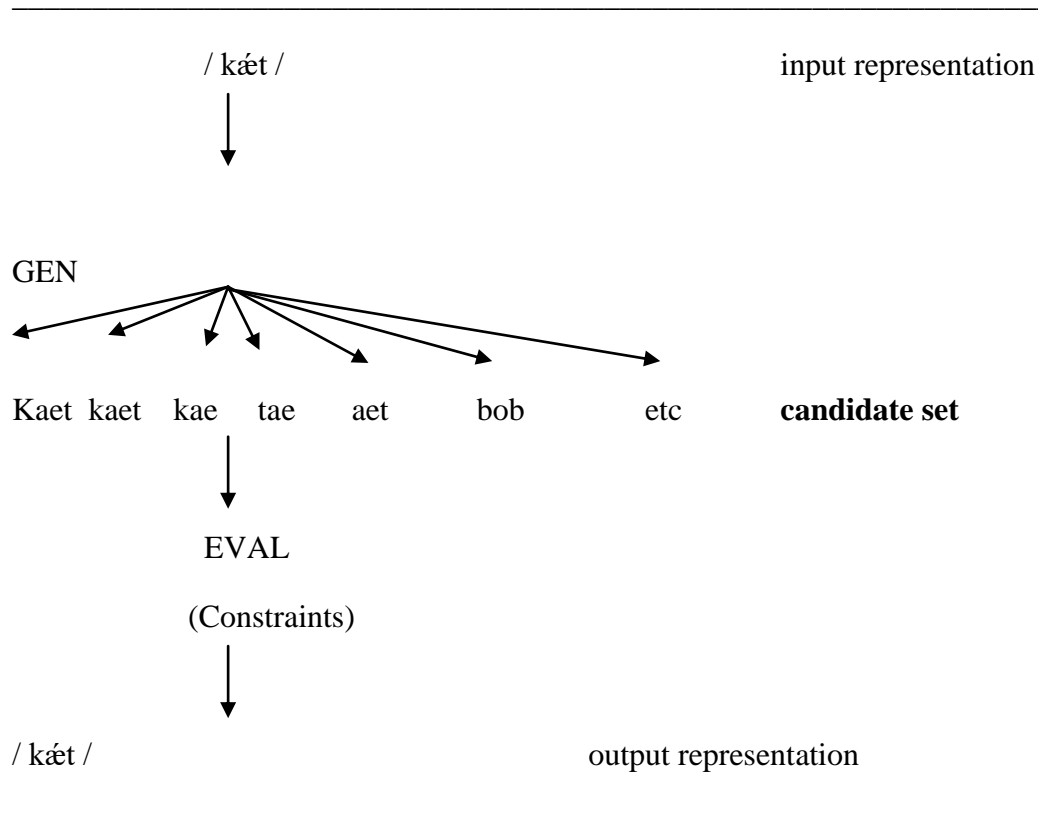


Figure 1: **Schematic of the grammar within OT**

*Formal model of OT (adapted from Archangel, 1997)*

**GEN:** Given an input representation, Generator provides a set of potential output forms.

**EVAL:** Given the candidate set created by GEN, Evaluator chooses the most optimal or harmonic output for the given input representation.

**CON:** A language-specific ranking of a universal set of Constraints is used by EVAL in determining the optimal output form.

### 2.8.4 Nature of Constraints

OT takes competing outputs of lexical items weighs them simultaneously against each other eliminates a majority of candidates for relevance reasons whittles the remaining set of candidates for mismatches with the phonological dimensions that are relevant and chooses the one output that best matches a speaker's intended utterance. This highlights an important shift from the study of mental representations and phonological rules to the discovery of constraints.

Specific constraints that have been drawn directly from OT and the study of fully developed languages (e.g., McCarthy & Prince, 1995), illustrating how they may be appealed to in accounting for developing systems. Constraints are of two basic types: faithfulness constraints and markedness constraints. Faithfulness constraints ensure that output representations resemble input representations. Therefore, these constraints require that all the segments in the input will be parsed in the output. Parse means that a segment in the input representation surfaces in the output representation. The specific constraint MAX requires that all segments be parsed. Given an input /kœt/, the output form [kœ] would be in violation of the constraint MAX because the /t/ of the input representation is not parsed into the output representation.

Faithfulness constraints also require that all the segments in the output be present in the input, thus preventing the insertion of segments. The specific constraint DEP prevents insertion. Given an input /kœt/, the output form [kœtE] would be in violation of DEP because the [E] in the output is not part of the input representation. Examples of faithfulness and markedness constraints (McCarthy & Prince, 1995) are:

\*MAX: Segments in the input must correspond to segments in the output. (No deletion.)

\*DEP: Segments in the output must correspond to segments in the input. (No insertion.)

\*IDENT [FEAT]: The place, voice, and manner features of segments of the input must surface in the corresponding segments in the output.

\*COMPLEX: Avoid consonant clusters.

In addition, certain faithfulness constraints prevent a word such as “cat” from surfacing as [bOb] because such an output form does not resemble the input form /kœt/ except in terms of the number of segments. Whereas MAX and DEP refer to segmental faithfulness, the constraint IDENT refers to featural faithfulness. The output form [bOb] would satisfy DEP and MAX in terms of segmental faithfulness: There are three segments in the input in the form consonant-vowel-consonant and three segments in the output also in the form consonant-vowel-consonant. Clearly though, [bOb] is in serious violation of faithfulness in a featural sense. The voiceless velar stop /k/ in the input is a voiced bilabial stop [b] in the output. The voiceless alveolar stop /t/ in the input is also a [b] in the output. The low front unrounded vowel [œ] in the input is a mid-back rounded vowel [O] in the output. This “unfaithfulness” in terms of place and voicing between segments constitutes violations of

constraints such as IDENT-PLACE and IDENT-VOICE. These constraints require that features (rather than segments) in the input must also be present in the output. Faithfulness constraints such as the aforementioned are central tenets of OT: They have been shown to have cross-linguistic validity in that they account for a variety of independently motivated patterns (e.g., McCarthy & Prince, 1995).

Within the OT framework, the two general classes of constraints, faithfulness constraints and markedness. Whereas, Faithfulness constraints evaluate an output relative to the structure of input with the aim for one to one correspondence, such that the two forms are identical, Faithfulness constraints ensure that output representations represent input representations. Therefore, these constraints require that all the segments in the input will be *parsed* in the output. *Parse* means that a segment in the input surfaces in the output representation. An example of three documented faithfulness constraints are ident [manner], Ident [place] and Max. Ident [manner] stipulates that the input and output must be identical in the manner of production. Ident [place] states that the input and output must be identical in the place of production. MAX a constraint that works against the deletion of segments that is maximise correspondence between input and output. Given an input /kæt/ , the output form /kæ/ would be a violation of the constraint MAX because the /t/ of the input representation is not parsed into the output representation. Faithfulness constraints also require that all segments in the output be present in the input, thus preventing the insertion of segments. The specific constraint DEP prevents insertion. Given an output /kæt/ the output form /kætə/ would be a violation of DEP because [ə] in the output is not part of the input representation.

Markedness constraints (alternatively referred to as wellformedness or structural constraints) are equally central to OT and have likewise been shown to account for many phenomena cross linguistically. These constraints require that outputs forms be unmarked in structure (Jacobson, 1998). Unmarked properties of language are those structures that are considered to be most basic because they are present in all grammars. Although markedness considerations are taken into account in all linguistic theories, OT is one of the few frameworks that incorporates markedness directly into the grammar. To illustrate, a markedness relationship exists between consonant clusters and singletons. All languages allow unmarked singletons to occur but not all languages allow more marked consonant clusters to occur.

Within OT the constraint \*COMPLEX is a particular markedness constraint that prohibits forms with consonant clusters. The possible output form [plei]. “play” incurs a violation of

\*COMPLEX because it contains the consonant cluster [pl-] This means that [plei] is a marked output form in comparison to for example [pei] which contains a consonant singleton and therefore does not incur a violation of \*COMPLEX.

Markedness constraints evaluate the structure of an output candidate independently with well-formed outputs being those that have the simplest phonological structure. An output that abides by a markedness constraint is going to be inherently simpler form. Examples of markedness constraint include:

COMPLEX (No clusters)

CODA (No final consonants)

FRICATIVE (No fricatives)

LIQUID (No liquids).

In application of these markedness constraint to the word “Glove” some well-formed outputs are [g<sup>^</sup>v],[gl<sup>^</sup>v][gl<sup>^</sup>b] and [gw<sup>^</sup>v ] respectively. In these examples the output is not compared one to one with input; instead, only the structure of the output itself is examined to establish whether it is simple or not. Markedness constraints (alternatively referred to as well-formedness or structural constraints) are equally central to OT and have likewise been shown to account for many phenomena cross-linguistically. These constraints require that output forms be unmarked in structure. Generally, markedness refers to the complexity of a given structure relative to another structure, as determined by, for example, language typologies, frequency of occurrence, and order of acquisition facts (Cairns, 1969; Greenberg, 1965; Hawkins, 1987; Jakobson, 1968; Maddieson, 1984). Unmarked properties of language are those structures that are considered to be most basic because they are present in all grammars.

Although markedness considerations are taken into account in all linguistic theories, OT is one of the few frameworks that incorporate markedness directly into the grammar. This is important because structural considerations that were formerly external are now presumed to be internal to Universal Grammar. To illustrate, a markedness relationship exists between consonant clusters and singletons. All languages allow unmarked singletons to occur, but not all languages allow more marked consonant clusters to occur.

Within OT, the constraint \*COMPLEX is a particular markedness constraint that prohibits forms with consonant clusters. The possible output form [pleI] “play” incurs a violation of

\*COMPLEX because it contains the consonant cluster [pl-]. This means that [pleI] is a marked output form in comparison to, for example, [peI], which contains a consonant singleton and therefore does not incur a violation of \*COMPLEX. The relationship between faithfulness and markedness constraints comes in their violability.

Not all faithfulness constraints are satisfied at all times, leading to differences between input and output forms. Similarly, not all markedness constraints are satisfied at all times, allowing typologically more marked forms to occur in certain circumstances. In essence, faithfulness constraints and markedness constraints are antagonistic: Faithfulness constraints may be violated in order to satisfy high-ranking markedness constraints, or markedness constraints may be violated in order to satisfy high-ranking faithfulness constraints.

Because constraints are assumed to be innate, part of Universal Grammar, and therefore universal to all languages, the way in which variation across languages is accounted for is in terms of the relative ranking of constraints. A particular constraint may be high ranked in one language, but low ranked in another. Take again the occurrence of consonant clusters. In English, consonant clusters occur, but in the language Fijian, for example, they do not (Schütz, 1980). In comparing English with Fijian, the presence versus absence of consonant clusters is attributable to the relative ranking of the constraint \*COMPLEX, which prohibits clusters. In English, \*COMPLEX must be ranked low, and violation of it is not serious. However, in Fijian, the very same constraint must be ranked high to ensure that optimal output forms do not violate it.

In this study therefore all outputs (speech samples) will be described according to constraints on the basis of OT. In this study all outputs will be treated as simple outputs and examined on the basis of the constraints and their forms in relation to the GEN which provides the grammar of English.

### **2.8.5 Application of Optimality Theory in assessment and evaluation of articulation and phonological impairments**

A conventional OT analysis of a sound system to characterise API is depicted in the form of a constraint *tableau* (Table 2). The input is shown in the upper left cell of the tableau and corresponds to the adult target form. Constraints are listed as column headings (e.g. Constraint 1, Constraint 2) and ordered from left to right based on their ranking in a child's grammar. The highest ranked constraint is in the left-most column, and all others are listed in

turn by their ranking; for example, in (Table 2), Constraint 1 is higher ranked than Constraint 2. For any given phonological description, only relevant constraints are displayed in the tableau; this is in lieu of listing the finite set of constraints in CON. Potential outputs to be evaluated are listed in rows beneath the input, and are cited by subscript letters (Cand<sub>a</sub>, Cand<sub>b</sub>) for ease of reference. Again, only relevant competitors are depicted in the tableau since the potential output candidates GEN are infinite.

Once a tableau is developed, the analysis requires an evaluation of each output candidate relative to each constraint of the grammar. In principle, the evaluation process takes place simultaneously in one fell swoop, but for ease of illustration herein, each output candidate is taken up step by step. The evaluation process itself involves identifying the constraint violations. A *constraint violation* occurs when a given output candidate fails to meet the stated conditions of a given constraint. In a tableau, this is noted with an asterisk (\*) in the corresponding cell.

**Table 2: Sample table**

Input	Constraint 1	Constraint 2
a. Cand <sub>a</sub> !		
☞ b. Cand <sub>b</sub>		*

In Table 2, for example, Cand<sub>a</sub> violates high-ranked Constraint 1, and Cand<sub>b</sub> violates ranked Constraint 2. Importantly, when a candidate violates a high-ranked constraint, this is in a *fatal violation*, and results in the automatic elimination of that output. Fatal violations are denoted in a tableau by an exclamation point following the violation mark (!). In Table 2, Cand<sub>a</sub> violates the highest ranked Constraint 1; this violation is fatal and, consequently, Cand<sub>a</sub> is eliminated as an optimal output. After each candidate is evaluated against the ranked set of constraints, the one with the fewest violations of high-ranked constraints (and certainly no fatal violations) is the optimal output realized in a speaker's productions. By conventional notation, the optimal output is identified with a *manual indicator* (☞).

In Table 2, this is illustrated by the elimination of Cand<sub>a</sub> due to a fatal violation of high ranked Constraint 1, with Cand<sub>b</sub> being chosen as the winning output. This study will examine the speech of learners with CP for words that have fatal violations and then account and

describe the violations on the basis of the OT. All the findings and generalizations will be based on this theory.

### **2.8.6. Common error patterns**

Three of the most common error patterns reported in the literature are fronting, stopping and final consonant deletion. (Locke, 1983). These patterns have been observed in both normally developing and phonologically disordered systems and they may be accounted for by appealing to conflicting faithfulness and markedness constraints (McCarthy & Prince, 1995).

From the perspective of OT, each of these error patterns reflects a degree of phonological unmarkedness. Specifically, coronals are unmarked relative to dorsals (Stemberger & Stoel-Gammon, 1991). In OT this is accounted for by the constraint \*DORSAL, which prevents velar segments from surfacing in the input. Stops are unmarked relative to fricatives (Ingram, 1989) as a result of the constraint \*FRICATIVES which prevents fricatives from surfacing.

Finally, open CV syllables are unmarked relative to closed CVC syllables (Ingram, 1989; Stemberger, 1996) because of a constraint known as \*CODA which prohibits syllable final consonants. As will be shown, markedness relationships of these types can be described by positing high ranking markedness constraints over faithfulness constraints.

#### **Fronting**

In a pattern of fronting, dorsal segments /k/ and /g/ are replaced by coronals [t] and [d], respectively, as in [ti] “key” or [do] “go.” An OT account of this error pattern would require positing the high-ranking markedness constraint, \*DORSAL, as in (7). This constraint would be ranked above a faithfulness constraint requiring that the input representation directly resemble the output representation. In this case, IDENT-PLACE ensures that place of articulation in the input is also preserved in the output. Notice the antagonistic nature of the markedness constraint relative to the faithfulness constraint.

\*DORSAL: Avoid dorsal segments. IDENT-PLACE: Preserve place features from input segments. Ranking: \*DORSAL >> IDENT-PLACE

The table below illustrates this relationship for the target word “key.” By ranking \*DORSAL above IDENT-PLACE, the grammar ensures that the less marked form, Candidate (b), will be the optimal output. Candidate (a), the faithful, target-appropriate output form for input /ki/, incurs a fatal violation of \*DORSAL because a dorsal segment [k] is in that output form.



This candidate, however, satisfies IDENT-PLACE because all the segments of the output retain the same place of articulation as their corresponding input segments. Candidate (b), on the other hand, satisfies \*DORSAL because there is no dorsal segment [k] in the candidate form. Yet this candidate does violate IDENT-PLACE because the /k/ of the input corresponds to a [t] in the output. Because \*DORSAL is ranked higher than IDENT-PLACE, a violation of the higher ranked constraint is considered fatal. This leaves Candidate (b) as the more harmonic candidate, and the grammar chooses [ti] as the optimal form, despite its violation of lower ranked IDENT-PLACE. Thus, for a child who presents a pattern of fronting, it is more important that dorsals be prevented from surfacing than it is for underlying place of articulation to be preserved. This reflects the relatively marked status of dorsal place in acquisition, and illustrates the ranking relationship of markedness over faithfulness constraints in learners's grammars.

Fronting: /ki/ → [ti] /ki/ “key” \*DORSAL IDENT-PLACE

### Stopping

The error pattern of stopping involves the substitution of stops for target fricatives, as in [teI] “say” or [du] “zoo.” An OT description of this pattern requires that a markedness constraint against fricatives, \*FRICATIVES, be highest ranked as in example below. This markedness constraint, in turn, must dominate a lower ranked faithfulness constraint, IDENT-MANNER, which requires that manner of articulation be preserved from the input to the output.

\*FRICATIVES: Avoid fricatives. IDENT-MANNER: Preserve input manner features.

Ranking: \*FRICATIVES >> IDENT-MANNER

The pattern of stopping is illustrated in a tableau for the target word “say” and the constraint ranking of \*FRICATIVES over IDENT-MANNER. Candidate (b) [teI] will always be more harmonic than the more faithful Candidate (a) [seI] because it is more important for fricatives to be prevented from surfacing than it is for manner of articulation to be preserved, as dictated by the constraint ranking. Specifically, Candidate (a) incurs a fatal violation of high-ranked \*FRICATIVES, while satisfying IDENT-MANNER. In comparison, Candidate (b) violates IDENT-MANNER, but satisfies higher ranked \*FRICATIVES. As in the pattern of fronting, a child who evidences stopping will opt for unmarked properties of the grammar.

Final consonant deletion

In the case of final-consonant deletion, target syllable structure of the shape CVC, such as /kœt/ “cat,” is realized as unmarked CV structure, as in [kœ]. The final /t/ will not surface because a child’s grammar has a high ranked markedness constraint against CVC syllables. This constraint, \*CODA, prohibits syllables from being closed by consonants, as in (11). \*CODA must be ranked higher than the faithfulness constraint, MAX, which requires that all segments from the input surface in the output. In this grammar, because \*CODA is ranked higher than MAX, it is better for an open syllable to surface than it is for the segments to be parsed.

(11) \*CODA: Syllables do not have codas. MAX: Segments in the input must correspond to segments in the output. (No deletion.) Ranking: \*CODA >> MAX

The tableau in (12) shows this relationship for the target word “cat.” A fatal violation of \*CODA by the faithful Candidate (a) allows for the unfaithful Candidate (b) to surface with /t/ unparsed. Ranking markedness over faithfulness constraints again yields unmarked structure as the optimal output form for the pattern of final- consonant deletion.

(12) Final-consonant deletion: /kœt/ → [kœ] /kœt/ “cat” \*CODA>> MAX

a. kœt \*! b. ↗ kœ \*

In addition to these common error patterns, a number of other prevalent patterns in learners’s speech have been described within an OT framework (e.g., Barlow, 1997; Barlow & Dinnsen, 1998; Bernhardt & Stemberger, 1998; Demuth, 1997; Dinnsen & Barlow, 1998a, 1998b; Goad, 1998; Lléo, 1996; Ohala, 1996; Ota, 1998; Pater, 1997; Smolensky, 1996a, 1996b; Stemberger, 1996; Velleman, 1996). Interestingly, all these acquisition accounts have involved conflicts between markedness and faithfulness, with markedness dominating. At first glance, this may give the impression that all learners’ grammars will be the same within OT, but clearly, there is variation within and across developing phonological systems.

### 2.8.7 Error analysis

An error is a form in learner language that is inaccurate, meaning it is different from the forms used by competent speakers of the target language. For example, a learner of Spanish might say "Juana es \*bueno," which is not what competent speakers of Spanish would say. The accurate form should be "buena." Error analysis (henceforth EA) is a method used to document the errors that appear in learner language, determine whether those errors are systematic, and (if possible) explain what caused them.

While native speakers make unsystematic 'performance' errors (like slips of the tongue) from time to time, second language learners make more errors, and often ones that no native speaker ever makes. An error analysis should focus on errors that are systematic violations of patterns in the input to which the learners have been exposed. Such errors tell us something about the learner's underlying knowledge of the rules of the language being learned (Corder, 1981). This study adopted Stephen Pit Corder's approach to error analysis (EA). Corder created five procedures to analysing errors

#### 1. Collect samples of learner language

This is the starting point of EA i.e. deciding what samples of learner language to use and how to assemble them. We identify three broad types of EA according to the size of the sample

##### A) Massive sample

-several samples from many learners

-Yields comprehensive list of errors representing entire population

##### b) Specific sample

One sample from a limited number of learners

##### c) Incidental sample

One sample of language use by a simple learner

Errors can be influenced by many factors e.g different errors in speaking and in writing. There are also variation of errors according difference in L1. The learner language used in the sample should preferably reflect natural or spontaneous language use although not much data is obtainable this way. This shortcoming seems to justify some measure of elicitation as through interviews, composition writing etc. Another factor to consider is whether the sample will be collected cross-sectionally (single point in time) or longitudinally (successive points over a period of time)

Data is collected over a period of time and compared. The speech samples in this study were captured through a picture naming task whereby the respondents named objects and their speech sample was recorded for further analysis. Focus group discussions carried out by the teachers also contributed in the creation of the sample for analysis.

## 2. Identify all the errors in a sample of learner language

At this point the issue is determining what constitutes an error and the procedure of recognizing one. Error is defined as a systematic deviation from the norm of the second language i.e. the standard written dialect. The researcher was required to differentiate between 'error' and 'mistake' since error portrays lack of competence while mistake is due to the failure by the learner to perform his or her competence. Mistakes may be due to inability to access the learner's knowledge of a target language rule and fall back on some alternative that they find earlier to access. Mistakes are even manifested in native speaker speech due to processing failure as a result of plans e.t.c. EA should focus on errors not mistakes.

Corder recognized the significance of 'interference' and identified 3 types:

### a. Normal Interference

The analysts able to assign meaning to an utterance on the basis of target language rules i.e.' not apparently erroneous 'but may be right by'chance'.

### b. Authoritative interpretation

If the learner is available, the researcher should ask him the meaning of the utterance the horses own mouth. This should yield an authoritative reconciliation.

### c. Plausible Interpretation.

The analyst should contextualise the utterance i.e. consider the context in which it was made in order to reach its meaning.

For each error, the researcher identified what speaker intended to say, and how they should have said it? For example, an English learner may say, "\*He make a goal." This is an error. However, what should the learner have said? There are at least two possible ways to reconstruct this error: (1) He MAKES a goal, and (2) He IS MAKING a goal. In this first step of an error analysis, remember that there may be more than one possible way to reconstruct a learner error. Tarone & Swierzbins (2009) offer another example from an English language learner:

Learner: ...\*our school force us to learn English because um it's, it's a trend.

Here are three different possible reconstructions:

Our school forced us to learn English because it was a trend.

Our school required us to learn English because it was a popular language.

Because everyone felt it was important, English was a requirement at our school.

The way you reconstruct a learner error depends on what you think the intended message is. An added complication is that any given learner utterance may contain errors at many levels at once: phonological, morphological, syntactic, lexical.

Finally, determine how systematic the error is. Does it occur several times, or is it just a performance slip (a mistake)? Even native speakers of a language make one-off mistakes when they're tired or distracted.

### 3. Description of errors

Once the mistakes are eliminated from the errors, what classification is the error? Is it language level (structural- phonology, etc...), general linguistic (passive sentences, etc...) or specific linguistic elements (nouns, articles, etc...).

This takes the form of a comparison of the learners interlanguage utterances in the target language i.e. determine the way those utterances ought to have been uttered in the target language. The analyst should focus closely on the surface properties of the utterance ignoring the possible sources of error. The simplest type of descriptive classification of errors is based on linguistic categories e.g. as in traditional pedagogic Error Analysis, the categories may correspond to those in structural syllabuses and language textbooks e.g. linguistic categories such as;

Clauses

Auxiliaries

Passive sentences

Conjunctions

Complements e.t.c.

Each general category is then broken down into sub-categories e.g.

Auxiliary

- o Do

- o Have

- o Be

- o Modals

Other general linguistic categories were identified by Politzer and Ramirez (1973) such as Morphology, Syntax and Vocabulary. This form of classification/taxonomy allows detailed description of particular errors and qualification of a corpus of errors. The alternative to a linguistic classification of errors is the use of a surface strategy Taxonomy which highlights the modes of alteration of the surface by such occurrences such as misordering of certain items, omissions and addition of certain items. This study took a purely phonological approach in the description of the errors made by the learners by examining the articulatory and phonological impairments made in learners sample speech.

#### 4. Explanation of errors

Once systematic errors in the sample of learner language were identified, it was important to find out what might have caused those errors. There are several possibilities. Some errors could be due to native language transfer (using a rule or pattern from the native language). Some could be developmental—errors most learners make in learning this language no matter what their native language. Induced errors may be due to the way a teacher or textbook presented or explained a given form (Selinker 1972). This study focused on developmental errors that are as a result of impairment brought out by Cerebral Palsy, a condition found in the respondents in this study. However it was noted that explaining errors in learner language isn't always straightforward; for example, sometimes an error may appear to have more than one cause. As Lightbown & Spada (2013, p. 45) say, "... while error analysis has the advantage of describing what learners actually do ... it does not always give us clear insights into why they do it."

It was noted that this was perhaps the most important stage for second language acquisition research as it involved an attempt to establish the processes that are responsible for L2 acquisition. Taylor (1986) has identified a number of possible errors sources as follows:

- a) Psycholinguistic

This relates to the nature of L2 knowledge system and the difficulties learners have in using it in production.

b) Sociolinguistic

It concerns issues such as the learner's ability to adjust or adapt their language in consonance with the social context e.g. formal and informal

c) Epistemic

It concerns lack of world knowledge by the learner.

d) Discourse

Involves problems in the organization of information into a coherent (meaningful) text.

Abbott (2015) has however observed that generally SLA research has principally focused on the first i.e. the psycholinguistic as the following observation indicates, "the aim of any Error Analysis is to provide a psychological explanation.

5. Evaluation of errors

In evaluation of the errors we asked how serious were the errors? Does it cause a lack of understanding? These procedural steps would later spawn the interlanguage hypothesis by Larry Selinker, which asserts the language learner will occupy a limbo state between the rules of the native language and target language being learned. For now, interlanguage hypothesis will be left alone as it is an extremely deep concept that warrants its own article and study.

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.0 Introduction**

The chapter discusses the methodology used to collect the linguistic speech samples from the learners of English as a second language in primary school . The section looks at the research design, area of study, the sample and the sampling procedure, data collection instruments, data analysis, and data presentation methods that the study applied in a bid to meet its objectives. The study methodology was linked to the objectives, the type of data expected to meet these objectives, the availability of this data, and the type of study being carried out.

#### **3.1 Research Design**

This study adopted a qualitative approach. The design put subjects in three cohorts according to their respective levels of severity. The three cohorts represented the levels of severity of the subjects in terms of being mid, severe or acute. This is in cognizance of the fact that the severity of the impairment varies among learners.

This study has used concurrent triangulation strategy in which qualitative and quantitative designs are combined to overcome the limitations involved in using either method separately (Kothari, 2004). While identification and description of the nature of impairments are interpreted using qualitative methods, correlations are often based on quantitative measures. Quantitatively, data is subjected to statistical analysis that involves the computation of percentages in summary tables followed by an in-depth discussion of the data. The descriptive approach determines and reports the way things are and helps to generate hypotheses as opposed to testing them (Mugenda and Mugenda, 1999). Qualitative and quantitative methods are both important to determine L1 acquisition achievement. As noted by Kothari (2004), a study that follows the concurrent triangulation strategy is “advantageous because it can result in well-validated and substantiated findings.”

#### **3.2 Target population and location of the study**

The study was conducted in St. Martins De Porres a school for Learners with Cerebral Palsy. This primary school is in located in Nyakach Constituency, Kisumu County, in Kenya handles learners who have been diagnosed. The school has a student population of 78 pupils and working force of 15 teachers trained to handle pupils with this condition. Our rationale



for selecting this school was based on our aim to capture the circumstances and conditions of the typical situation (Ellis, 1990) and the school presented a case over 60 pupils who are suffering from Cerebral Palsy. An additional reason was that one of the researchers (an ESL primary school teacher in Kenya) had professional links with the school and so could facilitate access to the research site.

During the research design phase, the researcher needs to consider a rationale for identifying and using a particular location as a data collection site (Marshall & Rossman, 1999). In this regard, a decision was made regarding those who would serve as the research study population. The study site or setting was identified based on the following reasons: it was a location where:

1. Entry or access was possible.
2. The appropriate people (target population) were likely to be available.
3. There was a high probability that the study's focuses, processes, people, programs, interactions, and/or structures that were part of the research question(s) would be available to the investigator, and
4. The research could be conducted effectively on the learners during the data collection phase of the study.

### **3.3 Sampling Procedure and sample size**

The researcher chose to use purposive sampling because; researchers use their special knowledge or expertise about some group to select subjects who represent this population. In some instances, purposive samples are selected after field investigations on some group, in order to ensure that certain types of learners or persons displaying certain attributes only are included in the study. Although this sampling technique has some serious limitations (for instance, the lack of wide generalizability), purposive samples are occasionally used by researchers since those who might not appear in sufficient numbers to be meaningful under more traditional random techniques, are purposively sampled (Glassner et al, 1983). The logic of using a sample of subjects is to make inferences about some larger population from a smaller one-the sample. In this research, the researcher used purposive sampling. The concept of purposive sampling was based on the notion that a sample can be selected that will mathematically represent subgroups of some larger population.

Since all the learners in St. Martins are diagnosed with Cerebral Palsy, the researcher used purposive sampling to sample pupils aged between 6 and 14 years in the school to participate in the study. Further 6 teachers who teach English as a subject were also purposively sampled to participate in this study.

Creswell (2007) argues that judging the merit of a sample size requires the establishment of details that are sufficient and appropriate for others to judge the analysis in the context of the setting. We choose a single case to obtain an in-depth insight into the articulation and phonological impairments of learners with Cerebral Palsy teaching English, with the knowledge that studying multiple in different schools may not allow for the rich holistic analysis we wished to obtain. This study consisted of a study sample of 27 learners. Further, a sample of six teachers who teach English language in the school participated in focus group discussions. Each pupil was be subjected to 60 words from a picture naming task covering all the English phonemes. Thus by triangulating evidence from teachers and pupils we aimed to provide an in-depth analysis of the case we set out to study and synthesise the articulation and phonological impairments in the speech of the learners with Cerebral Palsy.

### **3. 4 Data Elicitation**

The goals of the research determine among other things, the methodology to be used and amount of data required (Cheshire, 1982). The goal of this study was to describe and characterise the speech of learners with Cerebral Palsy with an aim of identifying the articulation and phonological impairments. In order to achieve these goals, three methods of data collection were employed:

The use of language/speaking tasks/picture naming tasks

This test provided information about a child's articulation ability by sampling both spontaneous and imitative sound production. cf appendix I

#### **3.4.1 Single words**

This section included 60 target words that gather information on 21 consonants and consonant cluster sounds. This allowed the respondents to respond to picture plates and verbal cues from the examiner with single-word answers that demonstrated common speech sounds on all the English phonemes covering the three places of articulation that is initial, medial and final position within a word.

### **3.4.2 Focus group discussion**

A focus group discussion consisted of six teachers who teach English participated in the discussion led through by a moderator who was the researcher. The focus group moderator nurtured disclosure in an open and spontaneous format. The choice of the focus group discussion was to generate a maximum number of different ideas and opinions from as many different people in the time allotted. There were three types of focus group questions:

Engagement questions: introduced participants to and make them comfortable with the topic of discussion

Exploration questions: got to the meat of the discussion

Exit question: checked to see if anything was missed in the discussion

The ideal amount of time set aside for the focus group was from 45 to 90 minutes.

Focus group was structured around a set of carefully predetermined questions – usually no more than 10 and the discussion was free-flowing. Ideally, participant comments stimulated and influenced the thinking and sharing of others. See appendix

### **3.4.3 Tape recording**

Pictures were used to elicit the test items. The researcher showed the child a picture and asked “What’s this? (What is this?). If the child did not name the item, additional cues were given that included questions, prompts, and request for imitation. Imitation was encouraged in cases where the child did not know the target word. Imitation was permitted to increase the available data set, especially among the youngest learners; however, some younger learners also refused to say the target word. By including imitated productions, the task difficulty was more similar across the age groups; however, it may have artificially enhanced the accuracy of certain phonemes at the youngest group Spontaneous productions were elicited when possible; otherwise, imitations were encouraged.

Each child’s speech was digitally recorded with a SONY ECM-MS907 stereo condenser microphone held within 16 inches of the child’s mouth. All learners were recorded in two play sessions on consecutive days. Recording each child in two separate sessions enabled us to collect multiple productions of a large number of target clusters. Each session lasted 20–40 min and took place in school.

In order to obtain the tape recorded speech samples from the pupils, the researcher employed the social network technique, whereby he approached the respondents that is both the pupils and teachers as ‘a friend of’ or a ‘friend of a friend of’. Having established a close relationship over a period of two weeks, the researcher then started moderating the Focus Group Discussions with the teachers and finally tape recording the speech of the pupils. The close relationship with the respondents ensured that the conversations recorded would be as natural as possible and in a relaxed atmosphere. The length of each tape recording was 10-15 minutes.

### **3.5 Data Analysis**

Data analysis was carried out using inductive content analysis which is a method of analysing written, verbal or visual communication messages (Cole, 1988). Through this method the researcher systematically and objectively described and quantified the articulation and phonological impairments in the speech of the respondents. Replicable and valid references from the data were made to the context in which articulation and phonological impairments appear, with the purpose of providing knowledge, insights and a representation of the facts.

After tape recording and later transcribing the speech sample of the respondents. The researcher also tape recorded the focus group discussions. The process of analysis of the speech samples from the respondents started with the preparation stage which was the selection of units of analysis (Guthrie, et al, 2004.) A unit of analysis can be a word or theme (Polit and Beck, 2004). In this study the units of analysis were words and focus group discussions session.

The next stage was the analysis stage which involved the researcher analysing the manifest content. At this point the researcher organised the qualitative data. This process involved open coding, creating categories and abstraction. In open coding the researcher created headings as observed from the data. Then, the list of categories were grouped under high order headings (Mc cain, 1988, Burnard, 1991).

In order to reduce the number of categories the researcher collapsed those that are similar and those that are dissimilar. By creating the categories, this provided a means of describing the phenomenon to increase understanding and to generate knowledge (Cavanagh, 1997). The last stage was the abstraction stage. Each category was named using content characteristic

words. Subcategories with similar events and incidents were grouped together as categories and categories grouped together as main categories.

Error analysis (Corder,1981) provides a methodology for investigating a learner's language. For this reason Error Analysis constitutes an appropriate starting point for the study of learner language and L2 acquisition. EA research is of use in this investigation as it provides the following guideline to be used in the study of impairments:

1. Collection of a sample of learner language
2. Identification of impairments
3. Description of impairments
4. Explanation of impairments
5. Evaluation of impairments

The data captured were speech samples. A classification system was developed to interpret and describe the articulation and phonological impairments in the speech of learners with Cerebral Palsy. Through error analysis the researcher examined the characteristics of the articulation and phonological impairments

### **3.6 Ethical Issues**

Learners are persons who have not attained the legal age for consent to treatments or procedures involved in research (Greig and Taylor 1999). In Kenya, anyone under the age of 18 is considered to be a child and therefore, this study was conducted among learners aged between 6 to 14 years. Researchers have an ethical obligation to their colleagues, their study population, and the larger society. The reason for this is that sometimes researchers especially social scientists delve into the social lives of other human beings. From such excursions into private social lives, various policies, practices, and even laws may result. Thus, researchers must ensure the rights, privacy, and welfare of the people and communities that form the focus of their studies. During the past several decades, methods of data collection, organization, and analysis have become more sophisticated and penetrating. As a consequence, the extent or scope of research has become greatly expanded. With this expansion has come increased awareness and concern over the ethics of research and

researchers. To a large extent concerns about research ethics revolve around various issues of harm, consent, privacy, and the confidentiality of data (Punch, 1994).

When learners are involved in a research activity, it is necessary to obtain their assent and the permission of their parents or teachers (Alderson, 1995). For this reason, the researcher obtained permission from the teachers involved in the school. This helped to give the teacher the opportunity to learn about the study, ask questions, and agree or decline their child's participation in the research. The informed consent was obtained in writing for future reference (App. V).

The researcher ensured that the classroom setting was safe in terms of guarding against any physical injury to the child. Furthermore, the researcher committed himself to the fact that any child who declined to respond to the questions was not coerced to respond. All these were meant to ensure the physical and emotional safety of the child. The extent of the anonymity and any potential areas where the confidentiality of the interview would be broken was explained to the teachers at the outset of the interview. With a letter obtained from the Graduate School; Egerton University allowing the researcher to proceed with fieldwork, the researcher obtained a field research permit from the National Council of Research and Technology (NCST) which was also counter-signed by the Kisumu County Director of Education (App VI).

This study considered these important ethical concerns as associated with research in general and with qualitative research in particular. As Babbie (1983) accurately points out, "All of us consider ourselves ethical; not perfect perhaps, but more ethical than most of humanity." Although, one problem in social science is that ethical considerations are subjective, the researcher made it clear that there would be full disclosure of the study purpose to the respondents and the confidentiality of all the information obtained.

Secondly participation in this study was voluntary. The information obtained in this study was used solely for the achievement of the objectives and not for any other purpose whatsoever outside the objectives of the study. The identities of the learners who participated in the study were protected. Finally permission to conduct this study was sought from the ministry of education and other relevant authorities.

Further the study ensured the following:

The information obtained was recorded in such a manner that the participants could not be identified.

Any disclosure of the participants' response outside the research cannot reasonably identify the subject.

The study and its results did not place the participant at risk of criminal or civil liability, nor was it be damaging to the participants' financial standing, employability, or reputation.

The research would be conducted on pre-existing data, documents, records, pathological specimens, or diagnostic specimens, provided these items are publicly available or if the information is recorded by the researcher in such a manner that subjects cannot be identified,

## CHAPTER FOUR

### DATA PRESENTATION, ANALYSIS AND DISCUSSION

#### 4.1 An Introduction

In this chapter we present the data on articulation and phonological impairments found in the speech of learners with cerebral palsy. The data is analysed using the Optimality Theory Tableau as shown forthwith, this is then followed by a discussion of the data.

Each participant was taken through a picture naming task.(See Appendix A). The 60 words were divided into four sets based on which consonants are correctly produced by 50% of learners who are typically developing (Sander, 1972). All stimulus words were carefully chosen so that they could be represented by small toys or objects, making it easier to engage the young learners in an elicited naming task.

Set 1 contained words starting with stop, nasal, and glide consonants: /p/, /b/, /n/, /h/, /m/, and /w/. Set 2 contains words starting with stop consonants: /k/, /d/, /t/, and /g/. Set 3 contains words starting with fricatives, liquids, and glides /f/, /l/, /j/, /s/, /r/. Set 4 contains words starting with fricatives and affricates: /v/, /tʃ/, /ʃ/, /z/, and /dʒ/.

The participants tried to name a picture three times. Recoding was carried out under normal conditions, in a quiet room with the door closed but no additional soundproofing material. Subjects were instructed to speak each word in isolation in their habitual tone accent and volume. During the recording, the speech stimuli (the target picture) were presented to the subjects. In the case of unknown the target picture, the target words were told and those pictures were repeated after some preset up order.

Speech samples were recorded using a SONY ECM-MS907 stereo condenser microphone placed within 16 inches of the learners's mouth. Broad phonetic transcription was used to examine the accuracy and the variability of learners's productions. University students who had normal hearing and training in phonetic transcription served as transcribers. The output words were transcribed independently using the International Phonetic Alphabet with diacritics for narrow phonetic transcription.

Consonant accuracy was measured by calculating the percentage of initial consonants that were judged to be allophones of the target segment during three productions of each word.



Whole word accuracy was measured by determining the percentage of segments within the word that were acceptable allophones. For example, a child whose imitative productions consisted of [pIg], [pIɣ], and [plk] for the target word “pig” would receive an accuracy score of 100% for the initial consonant, and 89% for word production (8/9 phonemes accurate).

Thirdly through focus group discussions, the researcher engaged the teachers in a discussion on the suggestions of the various remedies/ interventions that among the respondents who have API to help them become effective communicators. The discussion was also recorded for further analysis by the researcher.

The API were identified with the basis of the Optimality theory henceforth OT. First the basic unit of analysis was the word whereby the researcher targeted sounds in isolation. The words were looked at to identify the different phonemes and their respective positions within a word that is initial, medial or final. The researcher used a score sheet see appendix II to record the phonemes in words. Finally the researcher identified remedies/interventions from the focus group discussions held by the teachers. On the score sheet the researcher transcribed each of the 51 words and recorded them, a further 20 words found in words in sentences were recorded.

In order to achieve the objectives of this study the sample was divided into three Cohorts

Cohort I- Mild

Cohort II – Severe

Cohort III- Acute

Cohort I: Mild

In this group of respondents, their speech was characterized by few or less Articulation Phonological Impairments.

Cohort II: Severe/ Moderate

In this group of respondents, the speech was characterized by many of the Articulation Phonological Impairments majority of the respondents fell in this category.

Cohort III: Acute

In this group of respondents the speech is characterized by no response for majority of the linguistic tasks offered to the respondents. The learners in this category were classified as having speech which is unintelligible and also slurred.

### **Articulation impairments**

Articulation impairment refers to the inability to produce a perceptually acceptable version of particular phonemes, either in isolation or in any phonetic context. Learners may consistently produce a specific distortion (e.g. lateral lisp) or substitute another phoneme (e.g. [w] for /r/) (Grundy, 1989). Articulation errors are due to a peripheral problem where the wrong motor programme for the production of specific speech sounds has been learned (Fey, 1992).

Cerebral Palsy learners with speech articulation disorders have difficulties with the motor production of speech sounds (Bernthal, et al, 2008). Bauwman (2000) classifies Articulation impairments as substitutions (e.g., [w] for /r/, “th” for /s/), omissions, distortions (e.g., dental or lateral lisp) or additions. This study adopted and was guided Bauwman’s classification in the identification and documentation of articulation impairments in the speech of cerebral palsy learners learning English as a second language. The following is a characterisation and description of the impairments in the light of Optimality Theory (Prince and Smolensky, 2002)

#### **4.2.1 Omissions**

The speech of respondents was characterised by omissions of certain phonemes in the structure of the syllable in a word. The following five words namely cap, mobile, girl, knife and spade demonstrate this impairment.

Cap

This word has the phonetic transcription as /k<sup>^</sup>p/ the target phoneme in this word was the phoneme /P/ in final position. The word cap is a single syllable word with a CVC structure. From the speech of the respondents, the word was pronounced as [k<sup>^</sup>]

A respondent pronounced the word as [k<sup>^</sup>] in this respect the final consonant [p] was deleted

Input (Target word)	output
/k <sup>^</sup> p/	/k <sup>^</sup> /

From the grammar of Optimality Theory, the target syllable structure of the shape CVC is realised as unmarked CV structure. The final consonant [P] did not surface in the respondents articulation because of the highly ranked markedness constraint that is against CVC syllables. The constraint \*CODA prohibits syllables from being closed by consonants. This constraint is therefore ranked higher than the faithfulness constraint MAX which requires that all segments be parsed. In OT grammar, it is better for an open syllable to surface than it is for the segments to be parsed. In this respect the above production of the word cup without the phoneme [p] is in violation of the constraint MAX which states that all segments in the input must be parsed in the output.

**Table 3: Cup → [k^]**

CUP /K^P/	*CODA	MAX
A k^p	*!	
B k^		*

Ranking \*CODA >> MAX

The table 3 shows the relationship between for the target word cup. A fatal violation of the constraint CODA by the faithful candidate A allows for the unfaithful candidate B to surface with /p/ unparsed.

Mobile

The word mobile has the phonetic transcription realised as /mobael/. In this double syllable word, the researcher targeted the articulation of the phoneme /l/ in final position of the second syllable. The second syllable has the CVC structure. In the speech of the respondents the word mobile was realised as /mobai/

Input (Target word)	output
/Mobail/	/mobai/

Again in the output word /mobai/ the final consonant /l/ is deleted because in the OT grammar closed syllable structures are marked. The constraint \*CODA prohibits syllables from being closed by consonants. It is therefore important to note that the output violates the constraint MAX which requires that all segments in the input be parsed in the output.

However due to the fact that \*CODA is ranked higher than MAX, it allows for the unfaithful candidate /mobai/ to surface. The following table demonstrates this assertion.

**Table 4: mobile → [mobai]**

Mobile	*CODA	MAX
A mobile	*!	
B mobai		*

Ranking \*CODA >> MAX

Girl

The single syllable word girl has a phonetic realisation as /ge:l/. In this word the researcher was keen on the phoneme /l/ in the final position of the word. The syllable has the structure CVC. In the speech of the respondents however, word girl was realised as /ge:/ which has the structure CV which is unmarked.

Input (Target word)	output
/ge:l/	/ge:/

The output /ge:/ realised in the speech of the respondents violates the constraint MAX which prohibits the deletion of segments in the output form. However, since in the OT grammar the markedness constraint \*CODA is ranked higher than the faithfulness constraint, this allows for the appearance of the unmarked syllable structure CV. This is because it is better for an open syllable to surface than for the segments to be parsed. Ranking markedness over faithfulness constraints yields unmarked structures. The table 5 illustrates this.

**Table 5: ge:l → [ge:]**

Girl /gel/	*CODA	MAX
A gel	*!	
B ge		*

Ranking \*CODA >> MAX

Knife

In this word the researcher targeted the consonant /f/ in final position of the word knife. This single syllable word had a CVC structure. The word knife has the phonetic realisation as /naif/. In the speech of the respondents the word knife was realised as /nai/

Input (Target word)	output
/naif/	/nai/

It is noted that in the output the consonant /f/ in final position is deleted. The deletion of the final consonant makes the output to violate the constraint MAX which prohibits the deletion of any segments in the output and ensures that all segments in the input are parsed in the output.

**Table 6 Knife → /nai/**

Knife /naif/	*CODA	MAX
A    naif	*!	
B    nai		*

Ranking \*CODA >> MAX

Table four above shows the relationship for the target word knife. A fatal violation of \*CODA by the unfaithful candidate A allows for the unfaithful candidate B to surface in the speech of the respondents with /f/ unparsed. This is because in the OT grammar the constraint \*CODA is ranked higher than MAX thus making it easier for there to be an open syllable than it is for all the segments to be parsed.

Spade

The phonetic transcription of the word spade is /speid/. In this word the researcher targeted the phoneme /d/ in final position of the word and the consonant cluster /sp/ in initial position of the word. In the speech of the respondents the word spade was realised as /pei/

Input (Target word)	output
Spade	pei

The output /pei/ violates the constraint MAX. Since in the output there is deletion of the final consonant /d/. The constraint MAX requires that all segments be parsed in the output. The output however fulfils the markedness COMPLEX which requires the output to be unmarked. The markedness constraint COMPLEX prohibits forms with consonant clusters. Therefore the form /pei/ does not have the consonant cluster /sp/

**Table 7 Spade → [speid]**

Spade /speid/	*COMPLEX	MAX
A speid	*!	
B pe		*

Ranking \*COMPLEX>>MAX

Table 7 shows the relationship for the target word spade. When clusters are reduced to singletons, the constraint against syllables beginning with clusters \* COMPLEX is highly ranked. The ranking therefore accounts for the way the consonant cluster is reduced. The grammar makes it a less serious violation to delete a segment than it is to allow a cluster to surface.

**Table 8: A summary on omissions**

Input word	Output word	Omission
Cap	/ka/	[p]
Mobile	/mobai/	[l]
Girl	/ge/	[l]
Knife	/nai/	[f]
Spade	/pei/	[d]

Table 8 above shows omissions that occurred in various words in this study. Most of the omissions were prevalent in final word positions. These findings are in agreement with studies done in English languages ((Whitehill and Ciocca, 2000) and Cantonese (Manochiopinig, 2008)

### 4.2.2 Substitutions

According to Oluoch (2014), devoicing is a form of substitution attested among the learners acquiring English as a second language, where sound segments are interchanged between the input and output word. Mutua (2013) defines devoicing as a feature change strategy where some voiced segments that are not found in the sound inventory of the input language are devoiced. During the adaptation process by second language learners of English with cerebral palsy data indicated that sound change mainly involved the devoicing of the voiced consonants into the voiceless counterparts. For example, words such as *scissors* were pronounced as *zithaz*, *pencil* for *bensil*, *blue* for *pulu* and *carrot* for *kalot* (cock), From these examples,

Sound [z]>[s]

[b]> [p]

Substitution was seen to occur when a phoneme in the same position was exchanged with another phoneme but with different featural qualities. The constraint IDENT requires congruence between the input and output in terms of featural faithfulness. In the speech of the respondents with CP certain phonemes were observed to undergo substitution that is they were substituted with other phonemes with different features. In this respect the following words have phonemes which violated the constraint IDENT through substitution.

Scirssors

The phonetic realisation of the scirssors is /sizas/. In this double syllable word the researcher targeted the phoneme /z/ in medial position of the word. The input (target phoneme) /z/ has the following characteristics:

labiodental

Fricative

Voiced

The output of the target phoneme /th/ in scissors has the following features :

Dental

Plosive

## Voiceless

The above output therefore violates the constraint IDENT in terms of featural faithfulness  
 IDENT – PLACE / IDENT MANNER

Input	output realisation	
	Scissors	thithaz

\*IDENT – PLACE

-MANNER

**Table 9: Scirssors → [thithaz]**

Scirssors /thithaz/	MAX	UNIFORMITY	IDENT VOICE	IDENT MANNER
A scissors	*!	*!		
B thithaz			*	*

MAX >> UNIFORMITY >> IDENT VOICE >> IDENT MANNER

The output B in table 8 above is faithful to the constraint MAX since all the segments in the input are parsed in the output. The output also has observed the constraint uniformity since all the segments in the input and output follow the order CVCVC. However for the target segment which is the phoneme /z/ is realised as /th/ in this respect therefore the output representation violates the constraint IDENT-VOICE since voiceless while the input is voice.

Secondly the output also violates the constraint IDENT-MANNER since the input is fricative while the output is a plosive. In OT grammar the constraint Max is ranked higher than uniformity, IDENT-VOICE and IDENT MANNER. This ranking ensures the output B is the optimal output since it violates the lower ranked IDENT-VOICE and IDENT MANNER. It is a less serious violation of the grammar for a segment to have changes in its features that is manner and voice than for a segment to go unparsed.

### Pencil

In this double syllable word the researcher targeted the phoneme /p/ in initial position of the consonant cluster CVC in the word/pencil/. In the speech of learners with CP the phonetic



realisation of the word pencil was observed to be /bensil/. The phonetic properties of the input sound /p/ in this cluster are:

Bilabial

Plosive

Voiceless

The phonetic realisation in the speech of respondents with CP was /b/ which has the following phonetic properties:

bilabial

plosive

voiced

Input output realisation

Pencil /bensil/

\*IDENT- VOICE

**Table 10: Pencil [bensil]**

	MAX	UNIFORMITY	IDENT VOICE	IDENT MANNER
A pencil	*!	*!		
B bensil			*	*

MAX>>UNIFORMITY>>IDENTVOICE>>IDENT MANNER

Table 10 shows the output B as the optimal output. The output has obeyed the constraint MAX that requires that all the segments in input must be parsed in the output. The output has also obeyed the uniformity constraint since the both the output and input have the same CVC syllable structure. However the output violated the constraint IDENT-VOICE since the input /p/ is voiceless while the output is voiced.

Blue

In this single syllable word the researcher targeted the phoneme /p/ in initial position of the word. The word blue is realised as / blu:/ phonetically. In the speech of the respondents, the word was realised as/pulu/. The input / target phoneme /b/ has the following featural properties; Voiced

Bilabial

Plosive

In the speech of respondents with CP the phoneme /b/ in the word blue is realised as / p/  
Therefore /p/ has the following featural properties:-

voiceless

bilabial

plosive

The phonetic realization therefore violates the constraint IDENT in terms of voice which is exchanged / substituted for a voice phoneme in the word blue / blu:/ IDENT – VOICE

Input	output realisation
Blue	/pulu:/

\*IDENT – VOICE

**Table 11: blu → [pulu]**

Blue blu	MAX	UNIFORMITY	DEP	IDENT VOICE
A blu	*!	*!		
B pulu			*	*

MAX>> UNIFORMITY>>DEP>>IDENT VOICE

In the OT grammar the constraint MAX, UNIFORMITY and DEP are ranked higher than the constraint IDENT. This is because a violation of the highest ranking constraint MAX would be considered fatal. In table above the example B is the optimal one since it violates the

constraints of the lowest rank. It is a less serious violation for an output to violate a constraint in terms of the features than for it to go unparsed. The output /pulu/ therefore violates the two constraints DEP because of an insertion of a vowel in the consonant cluster. The output also violates the constraint IDENT in terms of voice since the input is voiced while the output is voiceless.

### Carrot

In this double syllable word, the researcher targeted the second syllable which has the structure CVC. In this structure the initial consonant /r/ was of interest to this study. The phonetic realisation of the word carrot is /kaerot/. In the speech of the respondents who took part in the study, the word was realised as /kaelot/. The input phoneme /r/ has the following phonetic properties; Voiced

Labiodental

Fricative

However the output phoneme in the speech of respondents with CP it is /l/ which has the phonetic properties as: - voiceless

Labiodental

fricative

Input    output realisation

Carrot    /kalot/

\*IDENT- VOICE

**Table 12: Kaerot → [kaelot]**

Carrot	MAX	UNIFORMITY	IDENT VOICE
A kaerot	*!	*!	
B kaelot			*

MAX>>UNIFORMITY>>IDENT VOICE

Table 12 shows the output B as the optimal output. In the grammar of OT, the output has obeyed the constraint MAX that requires that all the segments in input must be parsed in the out. The output has also obeyed the uniformity constraint since the both the output and output have the same CVC syllable structure. However the output violated the constraint IDENT-VOICE since the input /r/ is voiced while the output is voiceless. In OT grammar it is a less violation for an output to violate a constraint in terms of features than for it go unparsed that is why candidate B emerges as an optimal output.

[r] > [l]

**Table 13 : A Summary on Substitution**

Input word	Output word	devoicing
Scissors	Zithas	[z] > [s]
Pencil	Bencil	[p] > [b]
Blue	Pulu	[b] > [p]
Carrot	Kalot	[r] > [l]

Data in table 13 indicate that all the words had devoiced sounds. For example, the voiced alveolar fricative /s/ is realized as the voiceless alveolar fricative [z] as *scissors* /zithaz/, the voiced bilabial stop [p] is realized as the voiceless velar stop [b] in words like *pencil* for /bensil/ for, the voiced bilabial stop [b] is realized as the voiceless alveolar stop [p] in words such as blue for /pulu/ and the voiced liquid [r] is realized as the voiceless liquid [l] as *incarot* for /kalot/. These sounds were devoiced by the learners in this study in order to make the pronunciation of such words easier and smoother. This claim has been supported by evidence reported in several other studies on phonological adaptation such as Owino (2003), Mutua (2003) and Oduma (2011).

#### 4.2.3 Distortions

Distortion was used for realizations, which remained within the target phoneme. Examples from the study show the following phonemes in words with distortions.

Scissors

For this study the input/target word was scissors with a phonetic transcription as /sizez/. In this double syllable word the researcher was interested in the phoneme /z/ in the medial

position of the word **scissors**. The output representation in the speech of the respondents was found to be /zithaz/.

Input	output realisation
-------	--------------------

Scissors	/zithaz/
----------	----------

\*IDENT-VOICE

-PLACE

-MANNER

A look at each segment that constitutes the output, the following is observed:

The initial consonant /s/ in the first syllable has the following featural properties – -  
voiceless

-palatal

- fricative

In the output realisation the initial consonant is realised as / z / with the following featural properties

-Voiced

-palatal

--fricative

2. The second component of the word which has the second syllable scissors /z/ is realised as /th/. In the input word the featural properties of /z/ are: - fricative

-voiced

-palatal

While in the output the segment has the featural properties of /th/ as

- plosive

-voiceless

Labiodental

**Table 14: Scirssors → [zithaz]**

Scirssors /zithas/	MAX	*FRICATIVES	IDENT VOICE	IDENT MANNER
A Sizas	*!	*!		
B zithaz			*	*

MAX >> FRICATIVE >> IDENT VOICE / IDENT MANNER

Table 14 above shows the optimal output B violates the lower constraints IDENT VOICE and IDENT MANNER. The output however obeys higher ranking constraints such as MAX and \*FRICATIVES. In OT grammar MAX and \*FRICATIVES are ranked higher than IDENT VOICE and IDENT MANNER, because it is more important for segments to be parsed and for fricatives to be prevented from surfacing than it is for manner of articulation and voice to be preserved. The double line between IDENT VOICE and IDENT MANNER shows that the mutual ranking between them is irrelevant.

Bath

In this study the single syllable input word bath has a phonetic realisation / bath/. The researcher targeted the phoneme /th/ in final position of the word. The word has a syllable structure as CVC. From the speech of the respondents the realisation was /**bad**/. In this respect the target phoneme /th/ has the featural properties:

-Voiced

-alveolar palatial

-Plosive

Input

Output / target word

/Bath /

/bad /

\*IDENT-VOICE

-PLACE

**Table 15 Bath → [band]**

Bath /bath/	MAX	IDENT VOICE	IDENT PLACE
A Bath	*!		
B bad		*	*

MAX>>IDENT PLACE/IDENT VOICE

In the table above candidate B is the optimal output. The output violates lower ranking constraints IDENT VOICE and IDENT PLACE. The output however obeys the higher ranking constraint MAX whereby both the input and output both have the CVC syllable structure. The ranking of MAX higher than IDENT VOICE and PLACE ensures that the unmarked form occurs because it is a less violation for an output to violate lower featural constraints than for an output to be unparsed.

Phone

In this single syllable word the researcher targeted the phoneme /f/ in initial position. The word phone has the phonetic realisation as /fon/ with the syllable structure as CVC. In the speech of the respondents the word was realised as /bon/

/fon/ - / mbon/

The phoneme /f/ has the featural properties as :

voiceless

labiodental

fricative

The realisation of the phoneme /f/ as /b/ makes it to be:-

voiced

bilabial

plosive

**Table 16: phone → [mbon]**

Phone	MAX	FRICATIVES	IDENT PLACE	IDENT VOICE
A Fon	*!	*!		
B bon			*	*

MAX>>FRICATIVES>>IDENT PLACE/IDENT VOICE

Table 16 above shows candidate B as the optimal output. The candidate has obeyed the constraint MAX because both the output and input have CVC as the syllable structure. The output also satisfies the constraint \*FRICATIVES which prevents the occurrence of fricatives. The output however violates the constraint IDENT PLACE and IDENT VOICE. The ranking of MAX and FRICATIVES before IDENT PLACE and IDENT VOICE ensures that fricatives are prevented from occurring than it is for manner and place of articulation to be preserved.

Wheelbarrow

As the input word, the researcher targeted the phoneme namely [r] in the word **wheelbarrow**. The word has three syllables and the phonetic realisation is [wilbaro]. In the speech of respondents the word wheelbarrow was realised as [wibajo]. A look at the output representation shows that there is deletion of the consonant /l/ in the first syllable. Secondly, in the third syllable the consonant /r/ is replaced by /j/

Therefore the phoneme [r] was distorted to [j]

The phonetic properties of the word /r/ are voiced

Alveolar

Liquid

While the phonetic properties of /j/ are voiced

Alveolar palatal

Glide



Clearly this shows a distortion of the phoneme /r/

Input word	Output word	distortion
Scirssors	zithas	/s/ > /th/
Bath	Band	/th/ > /d/
Phone	Mbon	/f/ > /b/
wheelbarrow	Wibayo	/r/ > /j/

#### 4.2.4 Insertions

Data from this study shows respondents speech being characterised by insertions. An insertion occurred when a vowel or consonant was inserted in a syllable or before a consonant. Batibo (1996) says that as a process of inserting a vowel between two consonants or after a consonant in a syllable final position is called **epenthesis**. Vowel epenthesis is one of the phonological processes used in the adaptation of English words among learners in the present study. Languages with restrictions on syllable structure permit vowel epenthesis in order to satisfy these restrictions when dealing with borrowing words from other languages (Uffmann, 2006). Epenthesis involves a violation of faithfulness because the epenthetic segment has no counterpart in the input. Batibo (1996) reports that this is by far the most common method of consonant cluster nativization in Kiswahili among learners and adults. According to Mutua (2013), epenthesis is a process that involves the insertion of one or more sounds in the middle or final position of a word.

In the current study, vowel epenthesis is a phonological process whereby learners added one or more sounds in the middle or final position of the word. An additional vowel is inserted between a consonant and another vowel to form words such as *penseli* (pencil), *buluu* (blue), *gali* (girl) and *etuyi* (tree)

The following are examples of words from speech samples of learners with Cerebral Palsy in this study.

Pencil

In this two syllable word the researcher targeted the phoneme [p] in initial position together with the consonant [l] in the final position of the word. Both the first syllable and the second syllable have the structure CVC. In the speech of the respondents the word had the phonetic

realisation as **[pensili]**. A look at the input and the corresponding output shows an insertion of a vowel [i] at the end of the word.

Input                      output  
 [pensil]              → [ pesili ]

\*DEP

**Table 17: pensil → [pesili]**

Pencil /pensil/	CODA	MAX	DEP
A pensil	*!	*!	
B pesili			*

CODA >> MAX >> DEP

Table 15 above shows candidate B as the optimal candidate. In the ranking of the constraints, \*CODA is ranked as the highest followed by MAX and then DEP. A look at the output representation shows that the first syllable underwent a deletion of the consonant [n] and second syllable underwent an insertion of the vowel [i]. The constraint CODA prohibits a syllable from being closed by consonants as in B above. Max on the other hand requires that all the segments from the input surface in output. The output therefore avoids a fatal violation by obeying the constraints. However the output violates the constraint DEP which requires that all segments in the output must correspond to segments in the input. This constraint prevents insertion. From the above example it is noted that the vowel [i] is inserted in the final position of the word **[pensil]**. The ranking of CODA before MAX and DEP ensures that it is a less serious violation of the grammar to insert a segment than it is for a closed syllable to occur or for a segment to go unparsed.

ii) Blue

In this single syllable word, the researcher was keen to examine the consonant cluster **[bl]**. The input word blue has the phonetic realisation as **[blu:]**. In the speech of the respondents the word had the phonetic realisation as **[bulu]**. A look at the output representation shows an insertion of the vowel /ʌ/ in between **[b]** and **[l]**

Input                      output

Blue [blue] → [bulu]

\*DEP

\*COMPLEX

**Table 18: Blue → [bulu]**

Blue /blu/	COMPLEX	DEP	MAX
A blu	*!	*!	
B bulu			*

COMPLEX>>MAX>>DEP

From the table above candidate B is the optimal output. From the OT grammar the output obeys the constraint COMPLEX that outputs should not have consonant clusters and so ensures that all output forms are unmarked. The output also violates the constraint DEP because of the insertion of a vowel [U] in the consonant cluster. The output however violates the lowest ranking constraint MAX because it does not segmentally correspond to the input. Therefore in the OT grammar it is a less serious violation to insert a segment than for a cluster to appear.

### iii) Girl

In this single syllable word, the researcher targeted the two phonemes [g] in initial position and [l] in the final position of the word. The input / target word girl has the phonetic realisation as [gɔ:l]. In the speech of the respondents, the word was realised as [gɔ:li]. In the example therefore we observe an insertion of the vowel /i/ in the final position of the word.

Input

output

Girl - /gɔ:l/ → [gɔ:li]

\*DEP

**Table 19: Girl → [ge:]**

Girl /ge:l/	CODA	MAX	DEP
A ge:l	*!	*!	
B ge:li			*

CODA>>MAX>>DEP

Table 19 above shows the output B. The output is seen to obey the constraint CODA which prohibits syllables being closed by consonants and also the constraint MAX which requires segments in the input must correspond to segments in the output thereby there being no deletion. The output however violates the constraint DEP which requires that segments in the output must correspond to segments in the input thereby avoiding insertion. In OT grammar CODA is ranked higher than the faithfulness constraint MAX which requires that segments in inputs must surface in output. Violation of the DEP is a less serious violation than violation of CODA since it is better for an open syllable to occur than it is for the segments to be parsed or for a segment to be inserted.

iv) Tree

In this single syllable word, the researcher targeted the phonemes [t] and [r] in the consonant cluster [tr]. The input word tree has the phonetic realisation as [tri:]. In the speech of the respondents, the word was realised as / etuyi /.

Input    output  
 Tree / tri: /    → / etuyi /

\*DEP

**Table 20: tri: → [etuyi]**

Tree /tri:/	COMPLEX	DEP	MAX
A Tri:	*!		
B etuyi		*	*

COMPLEX>>DEP>>MAX

In the output form we note that an insertion of two vowels has occurred. The output form /etuyi / has an insertion of a vowel [e] before the word and also an insertion of a vowel [u] between the consonant [t ]and [ j]. The optimal output B in table shows that the output violates the constraint DEP which prohibits the insertion of segments in the output representation. The output also violates the constraint MAX which requires that the segments in the output must correspond to segments in the input. OT grammar ranks COMPLEX

before DEP and MAX since it a less serious violation for there to be an insertion and an output to be unparsed than for a consonant cluster to occur.

**Table 21: epenthesis**

Input word	Output word	epenthesis
Pencil	Penseli	[I]
Blue	Buluu	[U]
Girl	Gali	[I]
Tree	etuyi	[E]

In table 21 above, the vowel sounds [I] and [U] are inserted in the middle of the second syllable in words such as *penseli* (pencil), *buluu* (blue) and *gali*(girl) respectively. According to Watson (2011), vowel insertion is introduced in order to break consonant clusters in languages that do not permit consonant clusters in a syllable or even in words. Also, vowel insertion is introduced to prevent consonants at the end of words. For example, Yorùbá does not allow consonants to end words just like Bantu languages. However, the reason why the learners use epenthesis in this particular study is different from the above reasons. The use of epenthesis is meant to ensure that the articulation of the words acquired is simple during language acquisition. The process is also utilized by learners to achieve a smooth transition from a consonant to a vowel within a word. This is in agreement with Salami (2004) who argues in his study that the insertion f vowel is a pattern of simplification of speech among learners.

#### **4.3 Phonological Impairments**

According to Stampe (1973), a comparison of adult and child phonological systems reveals that child speech production errors are typically simplifications of adult models. These simplifications are not random. For example, a child does not substitute a [w] for /r/ during one production and a [t] for /r/ the next. Instead, the substitutions are fairly consistent. Some variation is expected due to phonetic context and the fact that the child is in the process of learning the adult system, but generally once the system is known, errors are predictable. In fact, once the adult figures out the system, the child’s intelligibility greatly increases.

Stampe (1973) further notes that learners with more severe articulation problems also demonstrate predictable errors. These learners show systematic patterns of sound change that

affect whole classes of sounds. These sound-change patterns are referred to as *phonological processes* or *patterns*, and they can influence classes of sounds or sound sequences. For example, one common phonological process is *stopping*, in which fricative sounds are replaced by stop-plosives.

This study adopts Stampe's definition of a phonological impairment as a systematic sound change that affects classes of sounds or sound sequences and results in a simplification of production. It should be noted that the sound change does not have to affect all the sounds within a class, but it must affect at least two. In the example of stopping, there are nine fricatives that might be affected. If only two of them were systematically changed to stops, this could still be labelled stopping, because two is the smallest sampling that can still be considered a class of sounds. Simply put, one sound error in a class does not make a process.

Other criteria for identifying phonological processes have been suggested. McReynold and Elbert (1981), for example, demonstrated how criteria could significantly change identification results. In their study they suggested that a sound change should have the possibility of occurring four times and be used at least 20% of the time before qualifying as a process. Several phonological processes have been identified in the research literature. Shriberg and Kwiatkowski(1980) listed more than 40 processes in their text on natural process analysis. Ingram (1989) suggested grouping these processes into three categories: (a) processes that affect the syllable shape of words, (b) processes that substitute one sound for another, and (c) processes that result in sounds becoming more like other sounds (assimilation). Bernthal and Bankson (1993) suggested two categories: (a) whole-word processes, which simplify a word or syllable structure and segmental contrast within a word, and (b) segment change processes, which involve some form of substitution for specific segments or types of segments, regardless of syllable or word position. Since Ingram's system has been used more frequently.

In this study, it is attested that Cerebral palsy learners have phonological impairments that bring difficulty with development of the speech sound system. This difficulty results in errors affecting entire classes of sounds, these impairments are in identifiable patterns (Gierut, 1998). In the sound system of the learners with Cerebral Palsy, it was observed that there was a problem in the production of sounds that are classified as "fricatives." In order to solve this problem, it was noted that the learners in pattern of phonological adaptation whereby they for example substituted fricative sounds with "stops" (such as "t" for "s"). This pattern is called

*stopping of fricatives* (Gierut, 1998). In other cases there was substitution of a velar sound such as "k" with alveolar sound "t" resulting in what is called *velar fronting*. In both examples, the child was substituting "t" for another sound. Further, some learners were observed to have difficulty producing certain sound sequences. For example, they deleted final consonants or omitted one element of a consonant cluster. This study borrows from Bernthal and Bankson (1993) patterns of phonological adaptation for learners of second language. The following patterns of phonological impairments were identified in the speech of the respondents with CP in this study.

#### **4.3.1 Consonant deletion**

Debora (2009) notes that learners with and without speech, language and/or literacy impairment, delete consonants when they name pictures to elicit single words. Consonant deletion seems to be more frequent in long words (words of three or more syllables) than in short words (words of one or two syllables). However, it may be missed in long words because they are not routinely assessed and, even if they are, there is little normative data about them

According to Mutua (2013), deletion is the omission of a sound segment or segments from a word. Mutua identifies three types of deletion – apocope, aphaeresis and syncope. Apocope refers to the loss of one or more sounds from the end of the word while aphaeresis is the loss of the initial sound(s) in a word. Syncope is the loss of one or more sounds from the interior of a word. Aphaeresis and Syncope are examples of the macro process of deletion. According to Okombo (1982:21), deletion involves words which have non-high vowels /e, ε, a, o/ which are deleted when followed by a vowel in a light syllable. Adhiambo (1981) asserts that vowels are lost in unstressed word-final and unstressed word internal positions. It takes place when they are adjacent to stressed vowels in order to avoid complex onsets and codas.

In the current study, Apocope is a phonological processes attested among the learners acquiring English as a second language. Aphaeresis and Syncope involve the learners deleting the initial and the interior sounds of a word during the process of acquisition. The process is manifested in words such as *gri:* instead of green, *litu* instead of little, *ari:* instead of orange and *wo:* instead of watch among others

The deletion occurred in the final consonant or consonant cluster in a syllable or word (Grunweel, 1997). The following words as shown below have their final consonant deleted

Green

The above single syllable word has a **CCVC** structure. In this study the researcher was keen on the [n] in final position of the word. The output representation in the speech of the respondents was observed to have an unmarked CV structure as in [gri:]. The final consonant [n] in the syllable structure did not surface in the output.

Input                      output

Green [gri:n]      → [gri]

\*MAX

**Table 22: Green → [gri:]**

Green [gri:n]	CODA	MAX
A [Gri:n]	*!	
B [Gri:]		*

CODA >> MAX

From table 22 the constraint CODA prohibits syllables from being closed by consonants. CODA is ranked higher than the markedness constraint MAX. The output B is taken as the optimal candidate since it violates the lowest ranking constraint MAX. In this example the input word /green/ had the output word as [ **gri:** ]. The final consonant [n] was deleted in the pronunciation of the word. The output therefore violated the consonant MAX which requires states that all segments be parsed that is input representation should surface in output representation. The output however obeys the constraint CODA which prohibits closed syllables. In OT grammar ranking of CODA higher than MAX makes it better for an open syllable to occur than it is for segments to be parsed.

ii) Little

In this single syllable word the researcher was keen on the pronunciation of the phoneme [l] in final position. The word has a syllable with the structure CVCC. The above word has the phonetic realisation as [litl]. In the speech of the respondents the word ‘little’ was realised as [litu]

Input                                      output

Little                                      [litu]



\*MAX

\*DEP

**Table 23: little → [litu]**

Little	CODA	DEP	MAX
A litl	*!	*!	
B litu			*

CODA>>DEP>>MAX

Table 23 above shows the relationship for the target word little. A fatal violation for the faithful candidate A allows for the unfaithful candidate B to surface with a deletion of the consonant [l] and an insertion of the vowel [u] in the output representation. In OT grammar CODA is ranked highly followed by COMPLEX and DEP. From the table we can note that the output B obeys the constraint CODA and COMPLEX. It however violates the lower ranking constraints MAX since not all the segments in the input are parsed in the output.

The highly ranking of CODA and COMPLEX makes it a less serious violation to delete or insert a segment than it is to allow a closed syllable or a consonant cluster to occur.

iii) orange

The word orange has two syllables of V and CVCC. In this study the word had a phonetic realisation as [ari]. An examination of the output representation reveals a deletion of the consonant [n] and [dz] in the second syllable

Input                      output  
Orange                      ari

**Table 24: arindz → [ari]**

Orange	CODA	MAX
A arindz	*!	
B ari		*

CODA>>MAX

Table 24 shows candidate B as the optimal output because it violates the lower ranking constraint which is MAX. In OT grammar CODA is ranked higher than MAX. The constraint

CODA prohibits syllables from being closed by consonants. Ranking markedness over faithful constraints yields unmarked output as candidate B. By ranking CODA higher than MAX makes it better for an open syllable to surface than it is for the segments to be parsed.

iv) Watch / watches

The above word ‘watch’ has a single syllable with the structure CVC. In this word the researcher targeted the phoneme [ts] in the final position of the word. In the speech of the respondents the word had a phonetic realisation as [wo].

Input                      output

Watch                      [wo]  
\*MAX

**Table 25: Watch →[Wo]**

Watch	CODA	MAX
[Wots]	*!	
Wo		*

CODA >> MAX

Table 25 shows the relationship for the target word watch. A fatal violation of CODA by the faithful candidate A allows for the unfaithful candidate B to surface with [ts] unparsed. From the table CODA is ranked higher than the faithfulness constraint MAX which requires that all segments from the input surface in the output. The output representation violates the lower ranking constraint MAX but obeys the constraint CODA. In OT grammar it is better for an open syllable to surface than it is for segments to be parsed.

Examples of apocope are presented in table 26 below:

**Table 26: Apocope**

Input	output	apocope
Green	gri:	[n]
Little	litu	[l]
Orange	ari:	[dz]
Watch	wo	[ʃ]

From table 26 shows apocope. For example, sounds [n], [l] and [dz] have been elipted in the word *green*, *little*, *orange* and *watch* among others. Learners employed this strategy in order to make the pronunciation of the words easier and smoother. This is in agreement with Adhiambo (1981) that deletion as a phonological process is a pattern of sound “errors” that typically developing learners use to simplify speech as they are learning to talk.

Learners in the current study employ aphaeresis and syncope because they do not have the ability to coordinate the lips, tongue, teeth, palate and jaw for clear speech as a result of their condition which is cerebral palsy. As a result, they simplify complex words in predictable ways of omitting some sounds and syllables until they develop the coordination required to articulate clearly. For example, they may reduce prenasalized stops to a single consonant sound like, /nɛβɛ/ for /ndɛβɛ / “chair” or delete the syllable in a word saying, /kɔ̃jɛ/ for /kɔmɔkɔ̃jɛ/ “rope.” Bantu languages have an open syllable structure, that is, there are no codas. The nucleus is an obligatory element while the onset is optional (Oluoch, 2014). For this reason, there were many cases of apocope; the loss of the final consonant sound (s) in a word because learners would try to avoid complex onsets and codas which seem difficult for them to pronounce through deletion. Clinically, two or three deletions of consonants across the affected words may indicate typical behaviour for learners up to the age of 6 to 11 years but variations outside these tolerances may mark impairment.

#### 4.3.2 Cluster reduction

In many varieties of African-American English, word-final consonant clusters are reduced. That is, certain members of the cluster, such as stops, are dropped. Therefore, words such as *desk*, *post*, and *walked* are pronounced as [dɛs], [pɔs], and [wɔk]. Consonant cluster reduction can also be found in varieties of American Indian English, as well. Penfield (1976) provides data from the Colorado River Indian Reservation in Parker, Arizona that show that speakers of English in this area (the data are from members of the Mohave, Hopi, and Navajo tribes) drop the final stop in a cluster, particularly when the cluster involves a nasal and a stop.

Therefore, words like *equipment* (SAE [ɪk<sup>w</sup>ɪpmɛnt]), *understand* (SAE [ʌndr<sup>w</sup>stænd]), and *student* (SAE [st<sup>w</sup>ɛdnt]) would be pronounced as [ɪk<sup>w</sup>ɪpmɛn], [ʌndr<sup>w</sup>stæn], [st<sup>w</sup>ɛdn], respectively. Leap (1976) also describes a similar phenomenon in Isleta English, a variety spoken among members of the Isletan Tiwa group. In that group, the second consonant of a final consonant cluster is dropped (*contest* (SAE [kɒntɛst]) -> [kɒntɛs]).

This is the phonological impairment that involved the deletion of one or more consonants from a two or three consonant cluster. From the speech of the respondents in this study, the following words were observed to exhibit this impairment.

Spoon

In this single syllable word the researcher was keen on the consonant cluster [sp] in the initial position of word. In the speech of the respondents the word was realised as [pu:].

Input                      output

Spoon                      [pu:]

The target word spoon [ spu:n ] has a consonant cluster [sp] this is the marked form. In the output form in the speech of the respondents, the word spoon has the realisation [pu:] and this is the unmarked form

Spoon              / pun/

**Table 27: Spoon → [pu]**

Spoon	COMPLEX	MAX
A spu:n	*!	
B pu:n		*

COMPLEX>>>CODA

A look at table 27 shows candidate B as the optimal candidate. The output obeys the faithfulness constraint COMPLEX which requires all outputs to be unmarked and therefore prohibit forms with consonant clusters. The output representation (candidate B) however, violates the lower ranking constraint MAX because it does not segmentally correspond to the input. From the table COMPLEX is ranked highly than MAX. In OT grammar, this ranking ensures a candidate that violates the high ranking constraint COMPLEX incurs a fatal violation if it has a consonant cluster in the output. For this particular impairment it is a less serious violation to delete segment than for a consonant cluster to occur.

Clap



## Swimming

The double syllable word swimming has the phonetic realisation / swimin /. In this study, the researcher targeted the pronunciation of the first syllable with the CCV syllable structure. From the speech of the respondents, the word was realised as /simin/

Input                      output

Swimming      /simin/

**Table 29: Swimming → [simin]**

Swimming	COMPLEX	MAX	ONSET
A swimin	*!		
B simin		*	*

COMPLEX >> MAX >> ONSET

Table 29 above the candidate B as the optimal output. The output obeys the high ranking constraint COMPLEX but violates lower ranking constraints MAX and ONSET which require that all segments are parsed and that a syllable must begin with a consonant respectively. The output is observed to delete the consonant /w/ in the consonant cluster /sw/ and therefore violates the constraint MAX .

**Table 30: Summary of cluster reduction**

Input word	Output word	Cluster reduction
Spoon	/pu/	[spu:n] > [pu]
Clap	/ap/	[clap] > [ap]
swimming	/simin/	[swimiŋ] > [simin]

Table 30 above shows cluster reduction both in initial and final position of words. For example the consonant cluster /sp/ in the word and /cl/ in the word clap, and /sw/ in the word swimming. It is noted that learners with CP engaged in cluster reduction as a form of simplification of their pronunciation.

### 4.3.3 Syllable reduction

Word segmentation plays an important role on phonological acquisition and emerges from the perception of phoneme's acoustic characteristics, including aspects of metrical phonology such as syllabic stress patterns and syllable position in words.

Syllable reduction or deletion described by the exclusion of one or more syllables during word production, is considered a typical phonological process that occurs in normal language development and is also frequent in SLI. During typical development, SD is more frequent in atonic syllables and is influenced by word length.

The occurrence of SR in the course of typical development is higher in medial position and, in cases of language impairments, can take place in more than one syllable in a single word. This fact reflects a deviant process of phonological acquisition and must be taken into account by speech and language pathologists during differential diagnosis of SLI.

SR involved the deletion of a syllable from a word containing two or more syllable. This deletion was found to have occurred in the unstressed syllable. Data from this study shows that some segments in the output were undergoing sound changes whereby one sound class replaced another class of sounds. In this impairment the / r/ became / w/ and /l/ became / w / or / j/. The following two words found in the speech of the respondents demonstrate this-

rabbit

For the purposes of this study, the researcher was keen on the initial consonant of the word. Rabbit. The word rabbit has two syllables with the CV and CVC structure. The phonetic realisation of the word rabbit is / rabit/. In the speech of the respondents the word had the phonetic realisation as / waebi /.

Input	output
	Rabbit                      waebi

**Table 31: Rabbit →[waebi]**

Rabbit	CODA	IDENT PLACE	MAX
A rabit	*!		
B waebi		*	*

CODA>> IDENTPLACE, MAX

Table 31 shows the relationship between the faithful candidate A which incurs a fatal violation of complex since the segment /t/ occurs in the output in the second syllable. Candidate B emerges as the optimal output since it violates the lower ranking constraints. An examination of the output shows that it violated has violated the constraint IDENT in terms of the featural faithfulness by substituting the initial consonant / r / with / w /.The consonant /r/ consonant is a Voiced

Fricative

labiodental

While the /w/ consonant is a voiced

Bilabial

fricative

In the first syllable, the output violates the constraint IDENT PLACE in terms of place of articulation since /r/ is labiodental while /w/ is a bilabial. The output also violated the consonant MAX in the second syllable by the deletion of the final consonant / t/. The output however obeys the higher ranking constraint CODA which prohibits syllables from being closed by consonants. In OT grammar the ranking of CODA before IDENT PLACE and MAX makes it a less violation for an output to delete a segment than for a syllable to have CODA.

ii) lamp

The second word that was observed to undergo this impairment in the speech of the respondents was the word lamp. The word has a phonetic realisation as /laemp/ and the syllable structure is CVCC/.In this output the researcher targeted the consonant /l/ in initial position. The phoneme /l/ has the following properties:

Glide

Fricative

Voiced



In the speech of the respondents that were used in this study, the word was realised as /waep/ a look at the output representation shows that the consonant /l/ in the word lamp is replaced by the consonant /w/ which has the following properties :

Voiced

Bilabial

Fricative.

Input	output
Lamp	waep

**Table 32: Lamp → [waep]**

Lamp	COMPLEX	IDENT PLACE	MAX
A lamp	*!		
B waep		*	*

COMPLEX >> IDENT PLACE, MAX

From table 32 candidate B emerges as the optimal output because it violates the lower ranking Constraints IDENT PLACE since the consonant /w/ in the output does not correspond with /l/ which is found in the input. The output also violates the constraint MAX which requires that all segments in the input word be parsed in the output, as seen from the table candidate A incurs a fatal violation of constraint COMPLEX which prohibits the occurrence of consonant clusters in the syllable structure. On the other hand candidate B obeys this constraint thereby emerging as the most harmonic output.

**Table 33: A summary of syllable reduction**

input word	Output word	Syllable reduction
Rabbit	/waebi/	[rabit]>[wabi]
Lamp	/wap/	[lamp]> [wap]

Table 33 shows syllable reduction which occurred in two words namely rabbit and lamp. Syllable reduction (SR) frequently occurs in Specific Language Impairment and can indicate

a deviant factor in the phonologic acquisition process of these subjects.

#### 4.3.5 Fronting

The error pattern involved dorsal segments being replaced by coronal that is the substitution of sounds in the front of the mouth, usually alveolar, for velar or palatal sounds. In the speech of the respondents with CP in this study the following words were observed to undergo this phonological impairment.

#### Key

The word key which has a phonetic realisation as /ki/ is a single syllable word with the structure CV. In this word the researcher targeted the phoneme /k/ in initial position. The phoneme has the properties – velar

Voiceless

Plosive

In the speech of the respondents the word was realised as /ti/. An examination of the output representation shows that the output phoneme is /t/ -alveolar

-voiceless

- Plosive

Input            output

Ki                [ti]

/Ki/

/ti/

**Table 34: Ki→[ti]**

Key /ki/	DORSAL	IDENTPLACE
A ki	*!	
B ti		*

DORSAL>>IDENT PLACE

Table 34 above illustrates this relationship for the target word key. By ranking \*DORSAL above IDENT PLACE the grammar ensures that the less marked form candidate B is picked as the optimal output. An examination between candidate A and B also shows that the faithful

candidate A incurs a fatal violation of the high ranking constraint DORSAL because a dorsal segment /k/ is found in the output. The output however satisfies IDENT PLACE because all the segments retain their corresponding place of articulation as their input counterparts. Candidate B on the other hand satisfies the high ranking constraint DORSAL because the /k/ does not occur in its output. However the candidate violates the constraint IDENT PLACE since /t/ does not correspond to /k/ in terms of place of articulation.

Gate

This single syllable word has the CVC syllable structure. In this word the target phoneme is /g/ in initial position. The phoneme /g/ has the following featural qualities:

-velar

-plosive

-voiced

Input	output
Gate	de
/Gate/	[de]

**Table 35: Gate → [de]**

Gate	DORSAL	CODA	MAX
A Gate	*!	*!	
B de			*

DORSAL >> CODA >> IDENT PLACE

Table 35 above illustrates that the constraint DORSAL is ranked higher than CODA and MAX which requires that the input representation directly resemble the output representation. In this case MAX ensures that all segments in input be parsed in the output.

By ranking DORSAL above CODA and MAX ensures that the less marked form that is candidate B emerges as the optimal output. The candidate obeys the higher ranking constraint DORSAL which requires avoiding of dorsal segments in output. The candidate also obeys the constraint CODA which prohibits syllables to be closed by consonants. However the

candidate violates the lower ranking constraint MAX which requires that all segments be parsed in the output deletion of the final consonant /t/ which happens to be missing in the output. Candidate A suffers fatal violation because it violates higher ranking constraints DORSAL and CODA.

banana

In this word the researcher targeted the phoneme /n/ in medial position of the word. The word was realised as / bajaja/ in the speech of one of respondents. The target phoneme /n/ has the properties:- alveolar

-plosive

-voiced

The output phoneme in the speech of the respondents was /j/ which has the following featural properties -palatal

-voiced

-fricative

Input	output
Banana	bajaja

**Table 36: Banana →[bajaja]**

Banana		
A Banana		
B bajaja		

The output therefore violated the constant IDENT in terms of place of articulation – IDENT-PLACE

Duck

The single syllable word duck has the syllable structure as CVC. In this word the researcher target the phenome /k/ in final position. In the speech of the respondents the word duck /d^k/ was realised as /d^b/.The target consonant /k/ has the following featural properties:

-Voiceless

Velar

In the output the consonant /b/ has the following features:-Plosive

Voiced

Bilabial

Input                      output

Duck                        d^b

Duck                        d^b

**Table 37: Duck → [d^b]**

Duck	MAX	DORSAL	IDENT PLACE
A d^k	*!	*!	
B d^b			*

MAX >> DORSAL >> IDENT PLACE

Table 37 illustrates the relationship for the word duck. The output d^b (candidate B) violates the lowest ranking IDENT PLACE. It obeys the highest ranking constraint MAX that ensures that all segments in input are parsed in the output. Both the input and output have CVC syllable structure. The output also obeys the constraint DORSAL which requires that dorsal segments are avoided. In OT grammar posting the high ranking markedness constraint ensures that a less marked form appears in the output. In this case the table above shows the optimal output as candidate B. This is because the candidate violates the lower ranked constraint IDENT-PLACE in terms of place of articulation whereby /k/ is a dorsal while /b/ is a bilabial.

The output form in the speech of respondents violates two consonants namely:-

IDENT – VOICE the target input is voiceless while the output is voiced

IDENT – PLACE – the target input a velar while the output is a bilabial

Spade

The filthy word is spade. The researcher targeted the final phoneme /d/ which has the qualities: -plosive

voiced

alveolar

In the speech of the respondent the word spade was realised as /speɡ/. In this output the target consonant /d/ was realised as /g/ which has following properties

Voiced

Velar

Plosive

In this respect therefore the output violates the constraint IDENT – PLACE since the output is an while the input in alveolar

**Table 38 a summary of fronting**

Input word	Output word	fronting
Key	/ti/	[ki]>[ti]
Gate	/de/	[geit]>[de]
Banana	/bajaja/	[banana]>[bajaja]
Duck	/dab/	[d^k]>[d^b]

Table 38 shows fronting in words, which is a form substitution. For example in the word key the [k] sound is replaced by the [t] sound while the sound [g] in gate is replaced the sound [d]. in this study it is noted that learners affected by CP found it easier to make bilabial and alveolar as opposed to velars such as [k] and [g]

#### **4.3.6 Deaffrication**

Deaffrication is also commonly occurring in both typical and atypical development (e.g. Bernhardt & Stemberger, (1998); Grunwell, (1982); Ingram, (1989); Smit, (1993); Smith, (1973). This process replaces affricates with alveolar stops in one or more contexts (e.g. ‘chew’ realized as [tu]). This type of phonological impairment involved the deletion of a stop component from an affricate leaving only the continuant aspect. From the speech of the respondents, the following words were found to undergo this impairment. The words are as follows:

## Chair

In the target word chair /tʃeə/ the researcher targeted the phoneme /tʃ/ in initial position. The target phoneme is /tʃ/ has the following properties:

Voiceless

Plosive

Palatal

In the speech of the respondents the word chair was realised as /ʃeə/

The target phoneme /tʃ/ which the researcher targeted in the initial position was realised as /ʃ/.

Input phoneme	output phoneme
/tʃ/	s
Plosive	fricative
Voiceless	voiceless
Palatal	labiodentals

Input	output
Chair	shea

**Table 39: Chair → [shea]**

chair	MAX	IDENT PLACE
Chea	*!	
Shea		*

In the output (Table 39), we can see that the output violated the following constraints:-

IDENT- MANNER.

The input is a plosive /tʃ/ while the output is a fricative.

IDENT –PLACE

The input is a palatal while the output is a labiodental.





Knife.

In this single syllable word with a CVC structure, the researcher targeted the final consonant/phoneme /f/. The phonetic realisation of the respondent the word knife is /naïf/. In the speech of the respondents, the word knife/naïf/ was realised as /naip/.

Input /f/ /naïf/	output /p/ /naip/
-voiceless	voiceless
-fricative	plosive
-labiodental	bilabial

Knife /naïf/ → /naip/

**Table 42: Knife → [naip]**

Knife	FRICATIVES	IDENT PLACE	IDENT MANNER
A naïf	*!		
B naip		*	*

FRICATIVES >> IDENT PLACE, IDENT MANNER

Table 42 above shows the constraint ranking of FRICATIVES over IDENT PLACE and MANNER. Candidate B [naip] is taken as the harmonic optimal candidate compared to candidate A because it is more important for fricatives to be prevented from surfacing than it is for manner and place of articulation to be preserved as dictated by the constraint ranking. From the table we can clearly see candidate A incurring a fatal violation of the high ranked constraint. The table further shows that the output violates two faithful constraints: - featural faithfulness. IDENT- MANNER whereby the input is a fricative while the output is a plosive and IDENT-PLACE since the input is a labiodental while the output is a bilabial.

ballons

The word ballons is a double syllable word with the first syllable with a CV structure while the second syllable with a CVCC structure. In this study the researcher was interested in the consonant cluster [ns]. In the second syllable. The word ballons is realised phonetically as /baluns/. In the speech of the respondents the word was realised as [balund].

Input	output
-------	--------

Ballons                      balund  
 Ballons                      balund

**Table 43: Ballon → [balund]**

Ballons	FRICATIVES	MAX	IDENT MANNER
A baluns	*!		
B balunt		*	*

FRICATIVES >> MAX >> IDENT MANNER

Table 43 shows a markedness constraint against fricatives. FRICATIVES is ranked higher since it must dominate a lower ranking faithful constraint, IDENT MANNER and MAX which requires from the input to the output. Candidate A is ruled out as the optimal because it incurs a fatal violation of the high ranked constraint FRICATIVES while candidate B obeys the high ranked constraint despite violating the lower ranked constraint MAX and IDENT MANNER. A look at the candidate b shows that this output representation is in violation of the constraint IDENT MANNER which requires featural faithfulness in terms of manner of articulation and MAX which requires that all segments be parsed.

voiceless

Coronal

Plosive

While the output representation [d] has the phonetic properties

Voiceless

Coronal

Plosive

	Input	output
	Tree	[dr:]

\*IDENT VOICE

## Scissors

The double syllable word scissors was used in this study. In the word the researcher targeted three phonemes that is [S]in initial position, [Z] in medial position and [S] in final position. The phonetic realisation of the word scissors is [sizas]. In the speech of the respondents, the word scissors had the phonetic realisation as [zithas]. In this respect the initial consonant [s] underwent voicing to become [z]

**Table 44: Scissors→ [zithaa]**

Input [s]	output [z]
Voiceless	voiced
Coronal	coronal
Fricative	fricative

The initial consonant [s] underwent voicing to get the output representation. In this regard the output representation violates the constraint IDENT –VOICE which requires feature faithfulness in terms of voice. The medial consonant [Z] has the feature properties as voice Coronal/labiodental Fricative. In the speech of the respondents the phoneme was realised a [th] which has phonetic properties as Voiceless Labiodental Plosive

Input	output
[z]	[th]
Sizas	zithas

IDENT VOICE

MANNER

PLACE

The output representation violates the constraints IDENT in terms of VOICE, MANNER and PLACE OF ARTICULATION.

**Table 45: Sizas→ [zithas]**

Scissors	FRICATIVES	IDENT PLACE	IDENT MANNER
A sizas	*!		
B zithas		*	*

FRICATIVE>> IDENT PLACE>> IDENT MANNER

In the study the researcher used the word rabbit with the intention of examining the initial consonant [r]. The word rabbit has the phonetic realisation as [ Wabi]. In the speech of the respondents the word was realised as [labit]

Input                      output

Rabit                      wabi

\*IDENT VOICE

From the output representation the initial consonant /l/ is different from the input representation [w] in terms of voice, manner. Therefore the output representation was seen to have violated the constraint\* LIQUIDS, IDENT MANNER AND IDENT VOICE.

**Table 46: Rabit→ [wabi]**

rabbit	LIQUIDS	IDENT MANNER	IDENT VOICE
A rabit	*!		
B Wabi		*	*

LIQUIDS>> IDENT PLACE>> IDENT MANNER

**Table 47–a summary of stopping**

Input word	Output word	stopping
Knife	/naip/	[naif]>[naip]
Balloon	/balund/	[balun]>[balund]
Scirssors	/zithaa/	[sizas]>[ziθ]

Table 47 shows the final consonant /f/ in the word knife being substituted with /p/ while the sound /n/ is substituted with /d/ in the word ballon and the phoneme /s/ in the word scissors

which is substituted with the phoneme [θ]. This shows that it was easier for the learners with CP to pronounce bilabials [p], alveolar [d] and the dental [θ]

#### **4.4 Consonant Accuracy**

A consonant is described in terms of place, manner of articulation and voice. Data from this study shows inaccuracies/misarticulations in terms of the place and manner of articulation. Error patterns were categorized as substitution, distortion, and addition. Substitutions were divided into manner only, place only, or a combination of these subcategories. Distortion was used for realizations, which remained within the target phoneme. For example, in the production /n/ → [nɫ], the realization was lateralized but still within the target /n/. Addition was used to describe the pattern that a phoneme was added to the target initial.

There were a total of 60 target words that were to be elicited through a picture naming task, while the number of respondents was 27. Therefore the total number of words elicited during the study was 1620. The researcher did the recording twice and therefore the number doubled to 3240.

In order to account for the percentages and the inaccuracies, the researcher took the total number of consonants that underwent substitution, omission or insertion for the each of the words divided by the expected consonants to be pronounced correctly which was 54 divided by 100%. Therefore for any accuracy/ articulation the percentage of the correct consonant PCC score would be:

$$\text{PCC score} = \frac{\text{Number of misarticulated consonant}}{\text{Total number of consonants produced}} \times 100$$

Total number of consonants produced

$N/54*100$  whereby N is the number of mispronounced/misarticulated consonants while 54 is the total number of correctly articulated consonants that are expected.

##### **4.4.1 Initial Consonants**

In this study consonant accuracy for initial consonants was examined in terms of manner and place of articulation in a word as summarised in table 40. Error patterns were categorized as substitution, distortion, and addition. Substitutions were divided into manner only, place only, or a combination of these subcategories. Distortion was used for realizations, which remained within the target phoneme. For example, in the production /n/ → [nɫ], the realization was lateralized but still within the target /n/. Addition was used to describe the pattern that a

phoneme was added to the target initial. Table 39 below shows the percentage distribution of the consonants in initial position.

**Table 48: Initial consonant accuracy**

consonant	substitution	distortion	insertion
[p]	56	15	4
[b]	45		
[t]	-		
[d]			
[k]	-		
[g]	-	02	4
[ʔ]			
[f]	-		
[v]	-		
[θ]			
[ð]			
[s]	-		
[z]	-		
[s^]			
[z^]			
[c^]	-		
[j^]	-		
[m]	-		
[n]			
[n^]			
[l]		22	
[r]	-	06	

[w]	-		
[j]	-		

Data from this study shows that initial consonants were observed to undergo substitutions, distortions and insertions. The percentage accuracy of each initial consonant is shown in Table 1. The most robust initial consonant was /P/ at (56%) for substitution, 15% for Distortion and 4% for insertions. The strongest consonants were /r/ /f/ /t/ /ts/ /dz/ /s/ /z/ /m/ /w/ /k/ /j/ /k/ /g/ at (0%) for substitution. However the consonants /l/ /r/ and /g/ had distortions of 22%, 06% and 2% respectively. In addition the consonant /g/ had insertions of 4% that mainly involved an insertion of a consonant /n/ before the consonant /g/. The dentals [θ] and [ð] and affricates [tʃ],[dʒ],[tʃ],[dʒ] as well as palatals did not have percentages because there was no response from the respondents. The accuracy of initial consonants was analysed by manner and place of articulation as shown in Table 49.

Substitution was the most common pattern (30 instances or 56% of all errors). The next most common pattern was distortion (24 instances or 45% of errors), followed by addition (4 instances or 8%). When substitution errors were broken down by feature, the most frequent error pattern involving a change of only one feature was combination (64), follow by manner (39) and place (24) instances. The most common distortion errors were alveolization (29 instances or 53.8% of distortion errors) and labialization (3 instances or 23.1%). Insertions were relatively rare.

**Table 49: Accuracy of initial consonants by manner and place**

Feature	Phonemes	Accuracy (%)
Manner		
Plosives	b, d	72.2
Affricate	tʃ	66.7
Nasal	m, n, ŋ	50.4
Fricatives	f, s, h	57.4
Liquid	l,r	0

Glides	w, j	72.2
Labial	p, b, m, w	64.8
Alveolar	t,θ, d, n, s, r, l	43.7
Alveolar Palatal	tʃ, j	38.2
Velar	k, ŋ	52.2
Glottal	h	0%
Labiodental	f, v	60
Dental	θ d	50

Plosives were the most robust manner class (72.2%); the lowest accuracy was for liquids (0%), fricative (57.4%), and nasals (50.4%), respectively. The most robust place of articulation was labial (88.9%); alveolar was the most vulnerable place of articulation was alveolar and alveolar palatal at 43.7% and 38.2 accuracy respectively.

**Table 50: Error patterns of initial consonants.**

Error patterns of initial consonants.		
Error pattern	#Occurrences	Error (%)
Substitution	82	75.9
Manner only	24	
Place only	11	
Combination	47	
Distortion	18	16.6
Addition	8	7.4
Total	108	100.0

The above table show the following conclusions for initial consonants for learners with Cerebral Palsy who participated in this study:



The most stable manner of production for initial consonants was fricatives, followed by plosives then by affricates

The weakest manner of production was glides followed by liquids then by nasals

The weakest / most vulnerable place of articulation was the glottal followed by the velar while alveolar and alveolar palatals showed almost similar vulnerability

The most robust manner of production was the bilabials, followed by labiodentals and then dentals.

Substitution was the most common error pattern followed by distortion and insertion.

When substitution errors were broken down by feature, the most frequent error pattern involving a change of only one feature was combination, followed by manner and place.

#### 4.4.2 Medial consonants

Consonants in medial position of words were similarly examined on the basis of manner and place of articulation. In this study consonants in medial position of words were observed to undergo omissions and substitution. It was noted that the most omitted consonant in medial position was the /dz/ with 54% while the most substituted consonant was /z/ with 63%. Consonants such as /r/, /m/, /l/, /n/, /s/ did not undergo any omissions. However consonant /r/ and /n/ had 35% and 20% as substitutions respectively. A comparison between the two shows that consonants in medial position had more substitutions as compared to omissions. Table below summarizes these findings.

**Table 51: Medial Consonants**

Consonant	Omissions %	Substitutions %
[l]	-	35
[r]	-	20
[s^]	54	
[j]	45	
[m]	-	
[n]	-	
[z]	19	63
[j^]	-	-

A look at place and manner of articulation for consonants in medial position shows that the most robust place of production was the bilabials followed by alveopalatals and lastly by alveolar. The most robust manner of articulation was the nasals followed by plosives and finally by liquids. While the most vulnerable manner of articulation for the respondent with Cerebral Palsy in this study was fricatives.

**Table 52: Accuracy of medial consonants by manner and place**

Feature	Phonemes	Accuracy (%)
<b>Manner</b>		
Plosives	j^	31
Affricate		
Nasal	m, n	20
Fricatives	z, s^	45
Liquids	l, r	38
Glides		
<b>Place</b>		
Labial	m	18
Alveolar	l, r, n, z	33
Alveolar Palatal	tʃ	24

Error patterns for medial consonants shows that substitution was the most common error pattern at 88.8% that is 45 instances. When broken down substitution by manner had 19 instances, place 16 instances while combination had 45 instances. Omissions had 7 instances which is 13% of the total expected production of consonants in medial position. This is summarised in table 53 below

**Table 53:Error Patterns of Medial Consonants**

Error patterns of medial consonants.		
Error pattern	#Occurrences	Error (%)
Substitution	45	88.8
Manner only	19	
Place only	16	
Combination	45	
Omission	7	12.01
Total	132	100.0

**4.4.3 Final consonants**

For the consonants in final position of words, the error patterns were categorized as substitutions and omissions. Substitution errors were subdivided into manner only, place only, and a combination of these subcategories. Omission referred to the case when the target phoneme was missing.

The percentage accuracy of each consonant in final position is shown in Table. The most substituted consonant in final position as /θ and /d/ at 44% and 45% respectively followed by the consonant /f/, /p/ and /n/ at 37%, 35% and 30% respectively. It was noted that consonants /g/, /l/ /dz/ and /w/ were not substituted therefore being the most stable consonant. In regard to omissions the most omitted consonant /d/ followed by /p/ and /n/ at 70%, 60% and 52% respectively. The consonants /dz/ and /s/ were observed to be the least omitted at 15% and 12% while the nasal/n/ was at 28% omission. From this table the robust consonants in final position of words were /k/, /g/, /f/, /l/, /θ/, /d/ and /w/ at 0% omission thereby meaning that they did not undergo any omission.

**Table 54: consonants in final position**

consonant	Substitutions %	Omissions %
k	4	-
d	7	70
g	-	-
f	37	-
l	-	-
dz	-	15
s	16	12
n	15	28
	43	
	44	
n	30	52
p	35	60
w	-	-

Analysis by manner of articulation revealed similar accuracy for nasals (mean percentage accuracy 66.7% and 72.2%, respectively) as shown in Table 54. Analysis by place of articulation showed that alveolar was the lowest accurate (mean percentage accuracy 63.9%), followed by velar (72.2%) and palatal was the most accurate (100.0%).

**Table 55: Accuracy of medial consonants by manner and place**

Feature	Phonemes	Accuracy (%)
Manner		
Nasal	m, n, N	72.2
Approximant	w, j	100.0
Place		
Labial	p, m, w	90.7
Alveolar	t, n	63.9
Palatal	j	100.0
Velar	k, ŋ	72.2

In contrast to what is seen in initial consonants and medial consonants, whereas substitution was the most common pattern, omission is seen as the most common pattern for consonants in final position. When substitution errors were broken down by feature, the most frequent error pattern involving a change of only one feature was place only. The other two features (manner only and combination) provided the same number of instance errors of 7. The total number of phoneme omission errors was 73

**Table 56: Error patterns of final consonants**

Error patterns of final consonants.		
Error pattern	#Occurrences	Error (%)
Substitution	18	32.5
Manner only	7	
Place only	11	
Combination	18	
omission	37	67.5
Total	91	100.0

#### 4.4.4 Consonant clusters.

A consonant cluster is a group or sequence of consonants that appear together in a syllable without a vowel between them. Jones,(1976).So as to give a complete picture of initial (onset) and final (coda) clusters in English, the following sources have been looked at: Heinz J. Giegerich (1992) who analyses consonant clusters in terms of generative phonology, Peter Roach (2002) whose analysis of possible phoneme combinations is based on more traditional structural approach, San Duanmu (2009) who supplements Giegerich's and Roach's descriptions of the phonotactic possibilities of English with the aspects of Optimality Theory and gives the reliable statistical data, and one internet source (<http://www.btinternet.com/~ted.power/clustersindex.html>) which offers the practical list of some consonant clusters in English.

The word, i.e. the syllable in English can begin with a vowel, with one, two or three consonants. No word in English begins with more than three consonants (Roach 2002: 71), thus the maximum number of segments in the word-initial consonant cluster is three. At the beginning of English words (syllables), there are 55 two-consonant clusters. In many cases the first element is /s/ and the second consonant is approximant /l, r, w, j/ (Roach 2002; Duanmu 2009). Initial Consonant clusters in English are shown in table 57

**Table 57:Table of consonant clusters**

category	Consonant cluster
Oral plosives	pr, pl, pj, pw, pf, ps, pʃ, br, bl, bj, tr, tw, tj, dr, dj, dw, kr, kl, kw, kj, km, kn, kv, gr, gl, gw
Nasal plosive	nj, mj, mw
fricatives	fl, fr, fj, vj, vw, θr, θw, θj, st, sp, sk, sl, sw, sn, sm, sf, sj, sr, sv, zl, ʃr, ʃm, ʃn, ʃp, ʃw, hj

The sample of 60 words involved in this study consisted of 12 consonant clusters as follows:pl, bl, tr, sp, sw, gr, fl, br, dr, kr, and tl all the consonants are found in initial position of the words except for tl which is found in final position for the word little.

The error patterns observed in this study were categorized as reductions and substitutions. Reductions were defined as the target consonant cluster being realized as a consonant (for

example, /pr/ → [p] or /kl/→[k]). Substitutions were defined as the target consonant cluster being realized as another totally different consonant or another consonant cluster altogether. (for example, /thr/→[c]). Table below gives a summary of the percentages of reductions and substitutions for the consonant clusters found in the speech of the respondents in this study.

**Table 58: Consonant cluster accuracy**

Consonant cluster		Reduction %	Substitution %
1	Pl	35	4
2	Bl	52	-
3	Tr	69	-
4	Sp	28	-
5	Sw	26	-
6	Gr	-	7
7	Fl	31	19
8	Br	-	24
9	dr	4	15
10	Kr	-	9
11	tl	7	-
12	fr	4	-

As seen in the above table reduction was the most common error pattern in consonant clusters. The consonant cluster [tr] in the word tree underwent the most reduction at 69% followed by [br] in the word blue at 52%. The most stable consonant cluster is [fr] in the word friend with 4% reduction and 0% substitution. The most substituted consonant cluster was [br] in the word brush at 24% the substitution involved coming up with a totally different consonant cluster altogether.

An observation from this shows a difficulty in the articulation of consonant clusters that involved two different articulators such as the tongue and the palate for the consonant cluster [tr] and [bl]. It was however easy for the articulation of the consonant cluster [sw] probably because it did not involve a direct contact of two articulators that is the lips. Furthermore it

was noted that between consonant clusters that are plosives such as [pl],[bl],[tr] and consonant clusters that are fricatives such as [fr],[fl],[sw], the ones that are plosives showed more reduction and substitution compared to the ones that have fricatives. For purposes of clarity and understanding table 50 below presents a summary of the articulation and phonological impairments identified in this study, showing the different positions in words that is initial, medial and final.



**Table 50: Summary table on articulation and phonological impairments in the speech of SLL children with CP**

Consonants	initial			mid			final			consonant clusters		
	Substitutions	distortions	insertions	omissions	substitutions		omissions	substitutions		reductions	substitutions	
	%	%	%	%	%	%	%	%	%	%	%	
P	56	15	7	r	-	64	k	-	4	pl	19	4
b	52	11	6	dz	-	-	d	70	7	bl	28	-
t	-	-	4	z	19	63	g	-	-	tr	37	-
d	4	-	-	m	-	-	f	-	37	sp	28	-
f	-	-	-	n	-	37	tʃ	-	-	sw	14	-
v	-	-	-	l	-	-	l	-	-	gr	-	7
tʃ	-	-	-	s	-	33	dz	-	15	fl	19	17
dz	-	-	-				s	16	13	br	-	24
s	-	-	-				n	25	15	dr	4	15
z	-	-	-				d	-	15	kr	-	09
h	-	-	-				0	-	44	tl	7	-
m	-	-	-				n	52	30			
n	-	-	-				p	60	35			
l	-	-	-				w	-	-			
r	22	11	-									
w	-	-	-									
j	-	-	-									
k	-	-	-									
g	-	-	4									
Average	7%	2%	1%		3%	28%	16%	15%		14%	7%	

#### **4.4.5 Discussion of findings**

The general goal of this study was to examine the speech of school going learners between the ages of 6 to 14 years of age suffering from Cerebral Palsy. The learners who consisted of a total sample of 27 learners who participated in the study. Through a picture naming task, single and double syllable words were obtained through recording. A sample of 60 words covering initial, middle and final positions of words was used in this study covering all the English phonemes according to the IPA chart.

In this study it's noted that the speech of Cerebral Palsy learners is characterised by imprecise articulation, whereby it was noted that consonants were mainly affected. The American Speech Language and Hearing Association define an articulation disorder/ impairment as the atypical production of speech sounds. In this study, articulation impairment is characterised by the omission, distortion, substitution, addition and or incorrect sequencing of speech sound in a word.

The consonants in this study were observed to undergo error patterns of impairment that included substitutions, omissions, additions and distortions. The error patterns in this study were the phonological impairments. Substitution was observed to be the most common error pattern for initial consonants. This finding is similar to studies done in English speaking countries (Leonard, 1998). The second most common pattern error pattern was omissions followed by additions and distortions. Whereas substitution was the most common pattern observed for initial consonants, omission was the most common pattern for final consonants. This finding is dissimilar for studies done on the English language (Platt, 1980) and Thai (Manochiopinig, 2008) The finding was similar to a study done on the Cantonese (Whitehill and Ciocca, 2000)

As earlier observed, initial consonants had imprecise articulations, especially for fricative and plosive. For example, the consonant [s], was substituted with [th] while [p] was substituted for [b], and vice versa. This finding was in agreement with studies done on English language whereby similarly there is imprecise articulation of word initial consonants for the consonants [n], [s],[z],[d] and [t] (Sawner and Wheeler,1999)

In regard to manner errors, it is noted that place and voice errors were the most predominant on initial consonants. Manner errors occurred more on plosives as compared to fricatives. Affricates underwent devoicing especially for consonants in initial position such as [dz] in

jumping. In initial position manner errors also involved a change of liquid to glide. For example the word rabbit to wabbit. Phoneme omission occurred three times more frequently on final consonants, a finding that is dissimilar to findings done on English language (Platt, 1980). Consonants in medial position underwent substitutions and omissions. The most omitted consonant in medial position was the /dz/ with 54% while the most substituted consonant was /z/ with 63%. Substitutions therefore were the most predominant compared to omissions.

In this study the pattern of feature retention in substitution is that place of articulation was less retained in the substituted sound than manner of production or voicing. The order/pattern of retention was as follows, voicing was most maintained, manner of production as the next most retained and place of articulation as the feature that is less retained when substitution occurred for initial consonants (See Table 39)

The accuracy of the consonant clusters were observed to be the lowest. Notably, by comparison to consonants in initial, medial and final positions, it was difficult for the respondents to articulate consonant clusters. The error patterns for consonant clusters showed that reduction which involved the target consonant cluster being realised as a consonant was the most common pattern. Substitution which was defined as the target consonant cluster being realised as another consonant was rare. (see table 49)

On phonological impairments in this study we observed that the speech of the respondents had instances of final consonant deletion which involved a deletion of the final consonant in word final position. Example Green [gri:n] → [gri] Secondly there was cluster reduction a phonological impairment that involved the deletion of one or more consonants from a two or three consonant cluster example /spoon/ → [pu:]. Thirdly there was backing which involved a substitution of a sound produced in the front of the mouth, with a sound produced in the back of the mouth "cap" for "tap. Fourthly there was fronting, an error pattern which involved dorsal segments being replaced by coronal that is the substitution of sounds in the front of the mouth, usually alveolar, for velar or palatal sounds example **Ki** → [ti] fifthly there was deaffrication a type of phonological impairment involved the deletion of a stop component from an affricate leaving only the continuant aspect example chair → [shea]

Sixthly there was syllable reduction an impairment which involved the deletion of a syllable from a word containing two or more syllable example Rabbit → waebi. Finally there was stopping which involved the substitution of a stop consonant for a fricative or an affricative

/naïf/ → /naip/. From the above listed phonological impairments it is noted that omission occurs in four of the impairments while substitution occurs in three of the impairments. Addition and distortions are not observed in the impairments.

In this study there were a total of 27 pupils who formed the sample. There were 21 boys and six girls. This sample is in agreement with studies done on Cerebral Palsy that show that this condition is likely to affect boys more than girls. In order to achieve the goals of this study, the sample was divided into three cohorts with the help of the teachers who took part in the focus group discussion.

Cohort I – mild

Cohort II- severe

Cohort III- Acute

Cohort one which was named mild consisted of 9 respondents whom 6 were boys while 3 were girls. The respondents were considered because of the following reasons. Firstly there was no record of phonological impairments seen in the speech samples collected. There were however a number of articulation impairments which included omissions, voicing and insertions.

In this cohort omissions were observed to occur in initial position of the words. For example words such as spoon and house were pronounced as [pu:n] and [aus] respectively indicating the omission of the phoneme /s/ and /h/ see figure 12 and 13. There were instances of change of voice especially for the liquid /r/ in the word carrot, which was pronounced as [kalot] while the word fish was pronounced as [fis]. Insertions were also prevalent in the three words namely blue, orange and spoon. In the speech of the respondents in this cohort the words were realised as [bulu],[horange] and [sipun] showing an insertion of the vowel /u/ in blue, an insertion of the consonant /h/ in orange and a vowel /i/ in spoon.

Cohort two was named severe, and it consisted of 14 learners whom 11 were boys while 3 were girls. This cohort formed the bulk of the phonological and articulation impairments found in this study. The most common phonological impairment was stopping and the most affected word was knife which was pronounced as [naip]. Followed by consonant deletion whereby the final consonant was deleted in words. Some of the words affected by this impairment were green which was pronounced as [gri:] and girl which was pronounced as [ge].cluster reduction was also prevalent in this cohort especially for the word spoon which

involved a fricative followed by a plosive. The fricative was deleted leaving the plosive. Therefore the word spoon was realised as [pu:n]. Finally the least common impairment for this cohort was deaffrication. The affected words for the respondents were chair which was pronounced as [shea]. In this case there was a deletion of the stop component leaving the continuant aspect.

In addition to the phonological impairments the following articulation impairments were prevalent in this cohort of respondents. The articulation impairments were omissions, substitutions, distortions and insertions. The most common articulation impairment was substitution, followed by omissions. Distortions were also prevalent though for a few instances were observed in this cohort.

Substitution occurred when a phoneme in the same position was exchanged with another phoneme but with different featural qualities. The most affected word according to this study was the word pencil having the phoneme /p/ in initial position. See figure 1 and 8 respectively.

Omissions were the second most common articulation impairment which involved the omission of phonemes in the structure of the syllable in a word. The most affected word was the word bad having the consonant /d/ in final position. See table

Distortions also occurred mainly for consonants in initial position of words at 16.6% see table 41. The most affected word was scissors which had an output realisation as [zithas]. Finally there were instances of insertions. The insertions occurred when a vowel or consonant was inserted in a syllable or before a consonant. Words that show insertion in this cohort include pencil which was pronounced as [pensili] with a vowel /i/ at the end of the word. There were also instances of insertions of vowels in the word blue which was pronounced as [buluu]. See figure 4.

Cohort three was named acute and it consisted of 4 boys. This cohort was characterised by respondents who exhibited slurred slow speech. 90% of the language tasks that were given to them received no verbal responses. Intelligibility was also a problem since the voices of the respondents were hoarse. For this cohort the researcher classified them as nonverbal or without verbal communication.

In theory the Optimality Theory (Prince and Smolensky, 1997, 2002; cf Smolensky, 1986) has adequately accounted for and characterised the speech impairments in the speech of

learners with Cerebral Palsy. One of its basic tenets is the mapping of speaker's competence to performance. In this way it has adequately catered for discrepancies that occur between what a speaker knows of a word (mental representation) and what actually the speaker says (the actual articulation). Through constraints and their ranking it ensures that every output violates some constraints of the grammar that are lowly ranked. In this regard all outputs are unmarked therefore violating lower ranked constraints as compared to higher ranked constraints. It is in the description of the various violations of the constraints that the researcher was able to account for the articulation and phonological impairments in the speech of the respondents. This study sought to characterise and identify impairments vis-à-vis identify the recommendations used by teachers to help the learners learning English as a second language affected by Cerebral Palsy. Results suggest that data on disordered patterns of L2 phonology acquisition can be used to guide speech-language pathologists (SLP) in diagnosing phonology disorders in SL2 learners.

#### Intervention strategies

##### **4.5.1 Overview**

To date, there have been few intervention studies on speech and language therapy with learners with CP. Pennington, Goldbart and Marshall (2005) completed a review of the literature available on speech and language therapy input with learners with CP. They found that therapy which focused on expressive language and communication and involved operant and micro-teaching methods were effective, however, there was no evidence on specific areas of intervention including articulation therapy.

Studies on speech and language therapy with learners with CP have focused on direct articulation therapy. Wu and Jeng (2004) completed a study with two learners with CP who attended an elementary school and had moderate articulatory difficulties. One child had therapy which focused on phonological therapy including minimal pair contrasts and speech bombardment. The other child received motor-based therapy which focused on phonetic placement (PPT), oral motor activities and speech modelling. Both therapy techniques did improve the specific phonemes that were targeted with the phonological approach appearing to help with maintenance.

The phonetic based therapy appeared to improve the production more than phonological based therapy. However as the authors state the long term effects of this are unknown but the phonetic approach appears to be more beneficial when intervention takes place. There are

some limitations to this study including having a limited number of learners in the study and very little written about their disability and if they had additional disabilities. This study does focus on specific programmes on actual speech rather than focusing on breath control.

Another study focused on phonetic placement therapy (PPT) and biofeedback (Marchant et al, 2008). The participant was a teenager who had CP, no additional disabilities, and was able to comprehend instructions associated with assessment and treatment. Her speech was her main way of communicating and she had a negative view on AAC. Therapy consisted of PPT with speech drills on five consonants and relaxation via sEMG biofeedback to “*inhibit muscle tension within the orofacial muscles using relaxation therapy*” (p 86). The results showed that phonetic placement did improve intelligibility at single word level. sEMG did encourage improved muscle control and maintenance of the improvements made from PPT. The use of one participant was an obvious limitation to this study. However drawing from this and the study by Wu and Jeng (2004) it does appear that articulation therapy has a positive impact on the phonetic repertoire of learners with CP. This is valuable research.

Through the focus group discussions (cf appendix ), the researcher sought to find out the intervention strategies that the teachers employed to assist the pupils with CP during the learning of English as a second language within a classroom setting. Various interventions were found to be implemented in order to improve perceptual intelligibility. Among these included articulation therapy and Core Vocabulary Therapy (CVT)

#### **4.5.2 Articulation Therapy**

The traditional articulation therapy approach was devised in 1939 by Van Riper after seeing therapy directed towards relaxation and sound production in words. The traditional approach is still used widely today (Van Riper & Erickson, 1996). This approach follows a systematic way to develop speech sounds that are not produced. It focused initially on listening to the target sound and distinguishing between that and another sound. The target sound was then produced in isolation, then the sound in syllables and non-words, then in words and finally in sentences.

It was also found that most teachers tended to use an eclectic approach to speech sound production including articulation and phonological approaches.

### **4.5.3 Core Vocabulary Therapy (CVT)**

Core vocabulary therapy focused on a selection of target words and used these repeatedly in clinical and natural settings (Holm, Crosbie & Dodd, 2005). This approach followed a structured programme involving teaching target words sound by sound, with additional visual prompts, and then syllable segmentation followed by whole word practice. These words are then practised in drills daily.

Intervention used a drill-play format (Holm et al, 2005; Paul, 2007). Drill play was chosen as it is motivating to the child while eliciting a large number of productions of the target words and sounds. The therapy activities used objects and colourful pictures to maintain the interest of the learners, and in particular toys which were noisy to encourage interest of the child with visual impairment. Families and teachers were also given the list of target words or sound and were asked to model the word at least 10 times per day. Intervention involved two types of approaches: an articulation therapy

#### **Articulation therapy**

The articulation therapy approach involved focusing on one phoneme at a time and progressed from listening to production in isolation to using the phoneme in everyday speech. This was deemed the most appropriate form of therapy as the learners had very limited phonetic repertoires which do not appear to follow the developmental norms as cited in Van Riper and Erickson (1996). The key steps in the articulation therapy were as follows:

##### **I. Auditory discrimination**

The child was introduced to the target sound to be worked on such as [f] by giving them the object cue (a toy fish) and then being told what the sound was. They were then introduced to another object (ball) which represented a contrasting sound such as [b]. Learners were instructed to listen for the target sound and identify the object that represented the sound. Feedback was given and the child was directed to the correct object.

##### **II. Production of the sound in isolation.**

Phonetic placement therapy (PPT) and cued articulation were used to encourage the child to produce the target sound in isolation. PPT consisted of teaching where the lips, teeth and tongue should be positioned when making a sound (Bleile, 1995). Bleile describes that the researcher can modify the techniques by using items such as food to encourage correct



positioning. An example of phonetic placement with [f] is: *“Instruct the client to touch his or her lower lip with the bottom of the upper front teeth and then to blow, which often results in [f]. In more severe cases, move the client’s lip to the correct positions using a finger or tongue depressor. Alternatively, instruct the client to “bite” the lower lip with the upper teeth and then to blow”* (Bleile, 1995, pg 324)

Cued articulation (Passy, 2016) was designed to facilitate production of sounds by using simple hand cues. An example of a cued articulation of [f] is used with photos of the index finger of the right hand between the lips and the chin. It is described as:

*“As the /f/ is articulated the shape of the hand remains the same but is moved downwards and forwards for approx. four inches (10cm). Then movement of the hand shows the air is continuing out of the mouth to produce this sound”* (Passy, 2016, pg 18).

The target sound was described using phonetic placement and then the hand cue for the target sound was shown. The child was encouraged to do this with hand over hand assistance to begin with. Cued articulation was used to give the child an indication of what sound was being made, however if they were aversive to this due to oral defensiveness this was reduced and auditory cues were relied upon.

Once the child had been introduced to the target sound they were encouraged to imitate the sound up to 10 times and games were played to increase the number of times the sound was spoken. If the child found it difficult to produce the sound they were given encouragement to try it again; such as “that was a good try, now try and put your top teeth on your bottom lip to hide it and then blow”.

### **III. Production of sound in consonant vowel (cv) and cvcv sequences**

When the child was able to produce the sound in isolation they were encouraged to produce it in a cv sequence, such as [fa], [fi]. At first the two sounds were separated to ensure that the child could make these sounds. The child was then encouraged to put the sounds together. The activities that were used for the sound in isolation were used for the sound in a cv combination. If the child was then able to become consistent with cv combination, vc such as [if] [□f], and cvcv, such as [f□m□], were attempted. If the child was able to say a word she or he was encouraged to fill in the space in songs using the cv or vc or cvcv word. None of the learners were able to move on from this stage during intervention.

#### **IV. Core Vocabulary Therapy**

The core vocabulary therapy approach focused on 10 target words. These were introduced randomly and two new words per week were presented, whilst the previous words continued to be focused on to encourage maintenance. This therapy was based on the research of Holm et al (2005). Only 10 words were used to ensure that the learners were not cognitively overloaded. The words chosen for each child was similar to those suggested by Holm et al (2005) and included the subject areas of

familiar people: mother, father, names of siblings

function words: toilet, help, fish

food: food, drink

places: home, school,

favourite things: drum, guitar, toy

#### **Schematic representations of the words**

It is often assumed that a speaker of a given language has some mental representation for a given word or sound, but sometimes that word has a very different surface representation. OT assumes an organization of the grammar whereby mental and surface representations are assumed to exist but they are referred to as input and output representation. In order to account for the API, the theory has three basic mechanisms that comprise the grammar, the Generator (GEN), Constraint (CON) and Evaluator (EVAL).

Each has a different function, but they work in tandem through parallel and distributed processing characteristic of connectionist models. GEN supplies all of the outputs that are permissible in any grammar of any language. For example, for the word “cat” outputs would include forms similar to input such as [kæt], [kæ] and [tæ] as well as less similar forms such as [bob] and [mu]. CON provides a library of constraints which limit and influence the myriad of possible outputs. The library of constraints in CON is shared universally by all languages. Thus all speakers have the same information available in GEN and CON. EVAL on the other hand is child specific. It provides ranking of the constraints in CON by importance and relevance to the sound system of the particular language at hand.

The role of EVAL is to compare the outputs of GEN against the universal set of constraints of CON. On the basis of this comparison EVAL then selects an “optimal” output that best

matches a child’s intention. An “optimal output” is defined as the output that violates the fewest number of high ranked constraints in the grammar and consequently it emerges as the winning production. These constraints are ranked in a language specific order. This allows for each language to have its own ranking thereby permitting variation in the types of grammars that are observed. One crucial aspect of this framework is that constraints are violable. In other words it is possible for a grammar to choose an optimal candidate that does not satisfy every constraint. In fact, every possible output form will violate some constraint of the grammar. The following is a summary of the schematic representations of the words that emerged from the data of the speech samples obtained from this study of the learners with CP

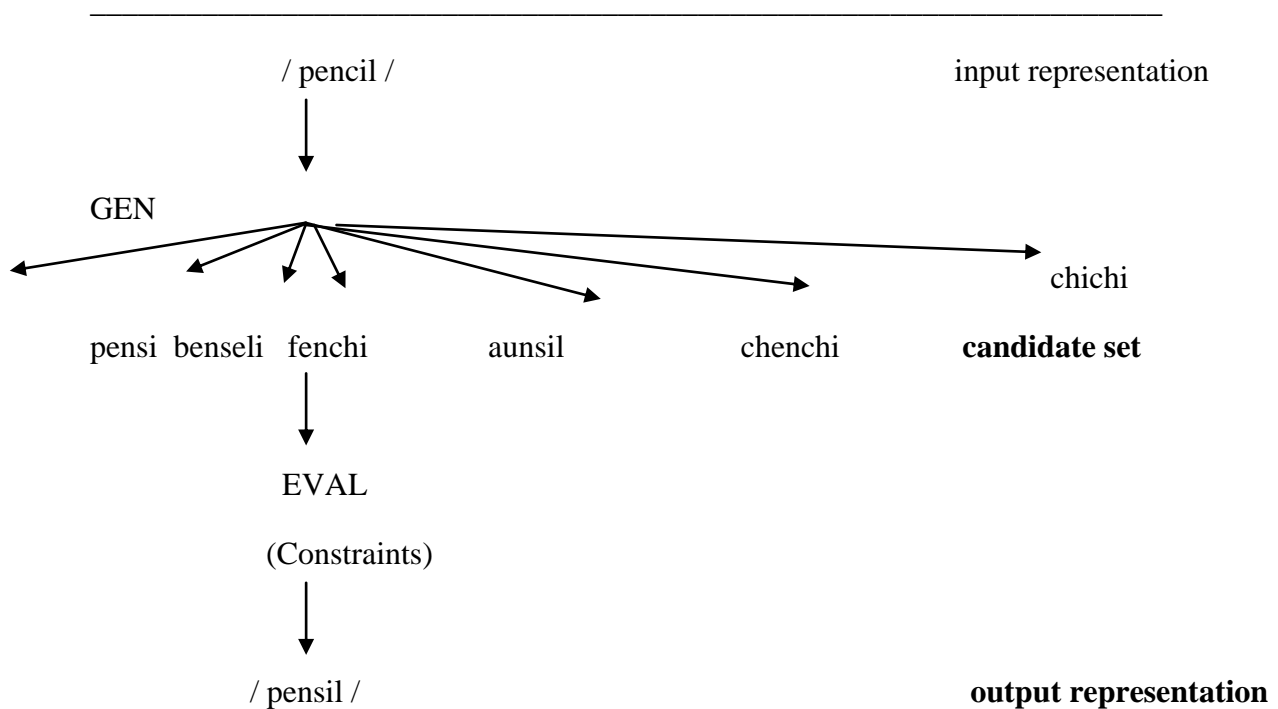
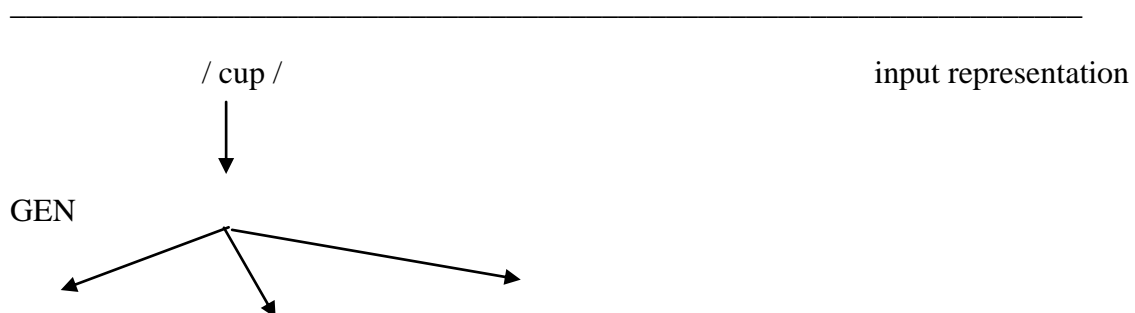


Figure 2: Schematic representation of the word pencil in OT grammar



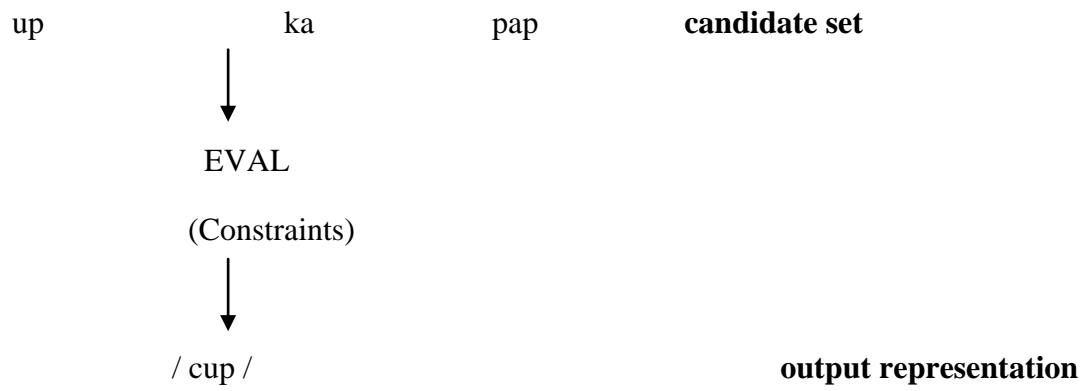


Figure 3: Schematic representation of the word cup in OT grammar

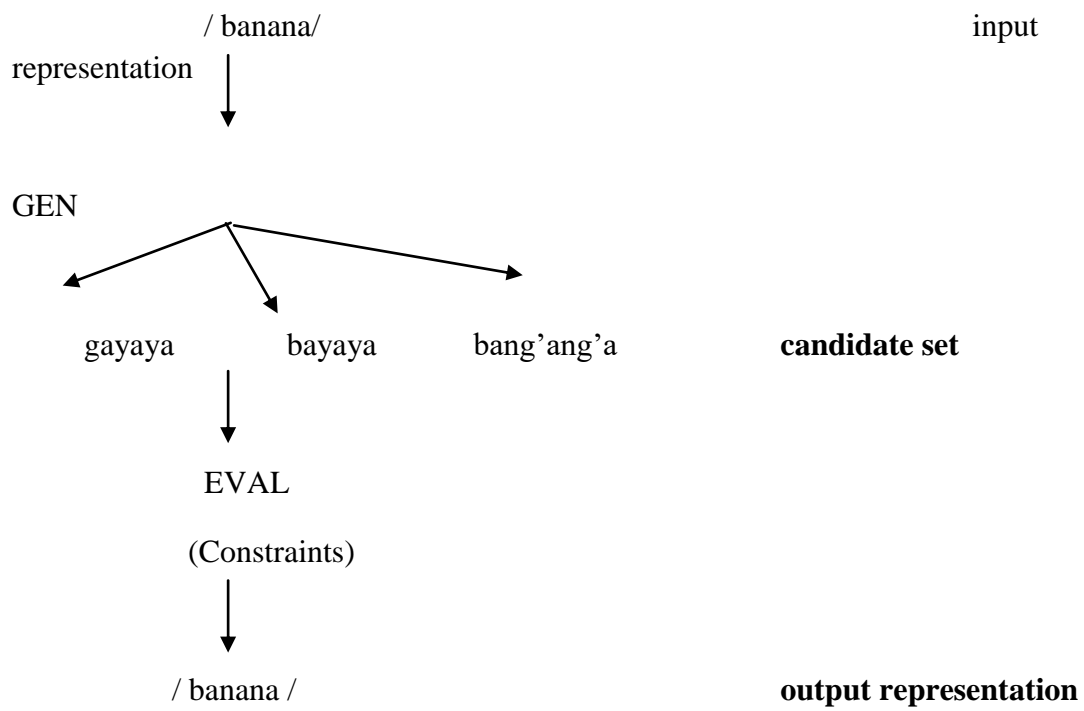


Figure 4: Schematic representation of the word banana in OT grammar



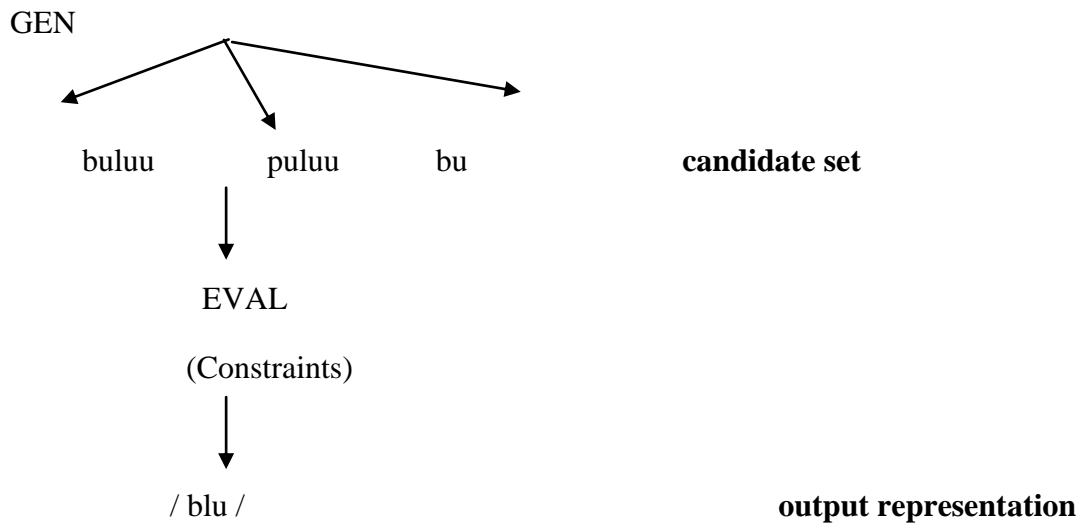


Figure 5: Schematic representation of the word blue in OT grammar

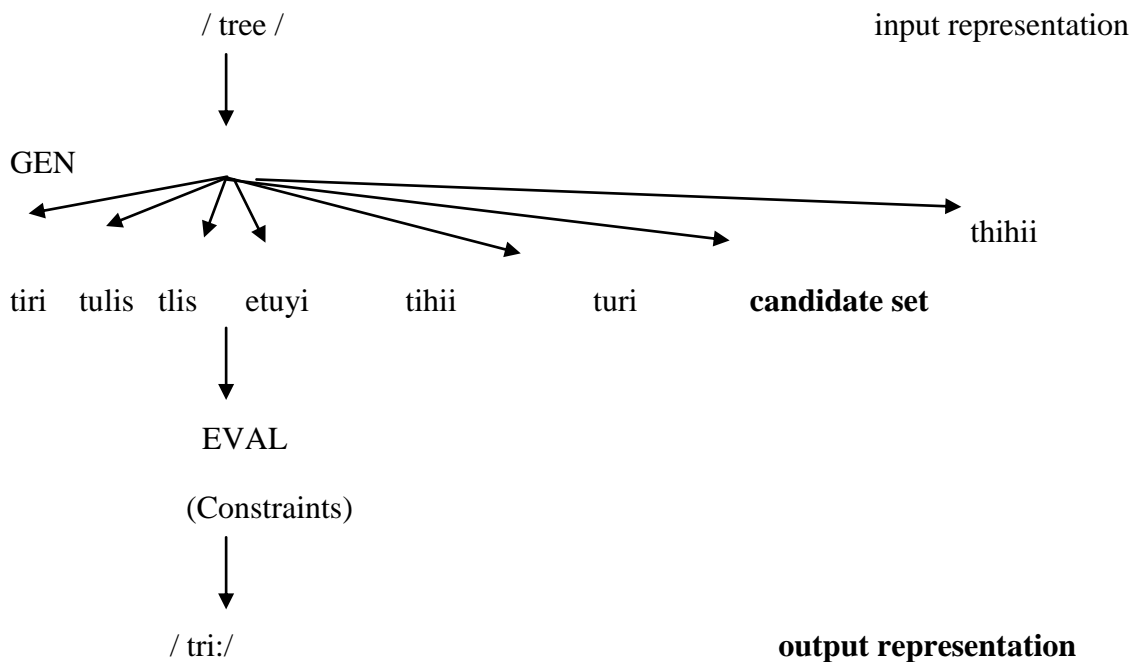


Figure 6: Schematic representation of the word tree in OT grammar

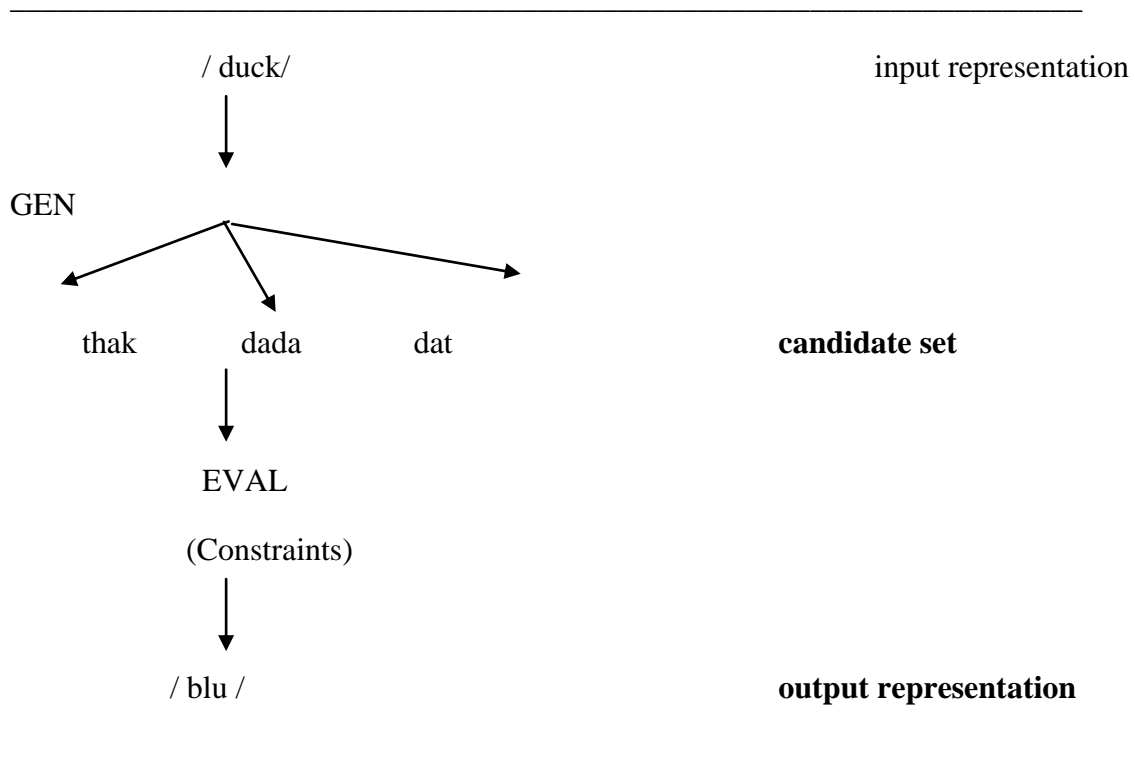


Figure 7: Schematic representation of the word duck in OT grammar

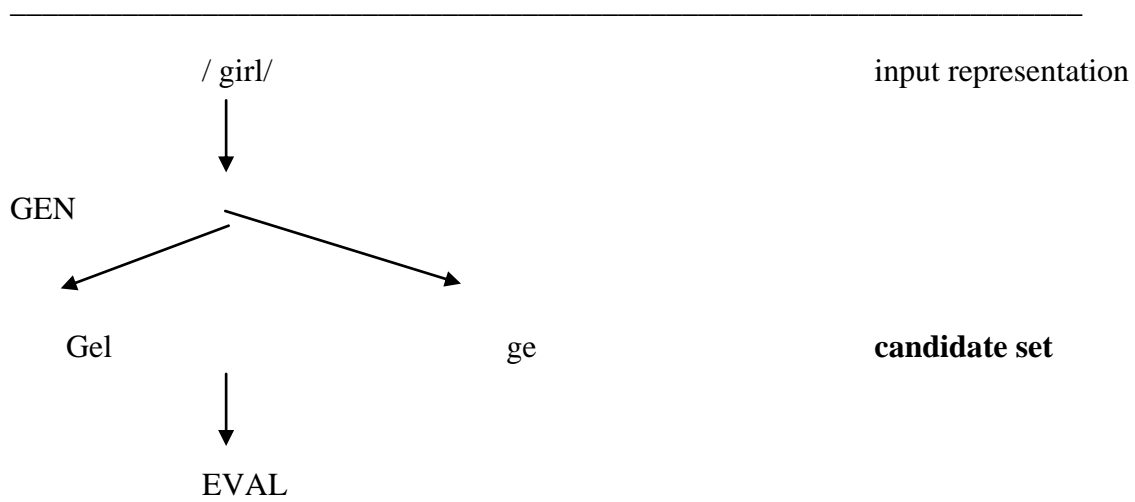




Figure 8: Schematic representation of the word girl in OT grammar

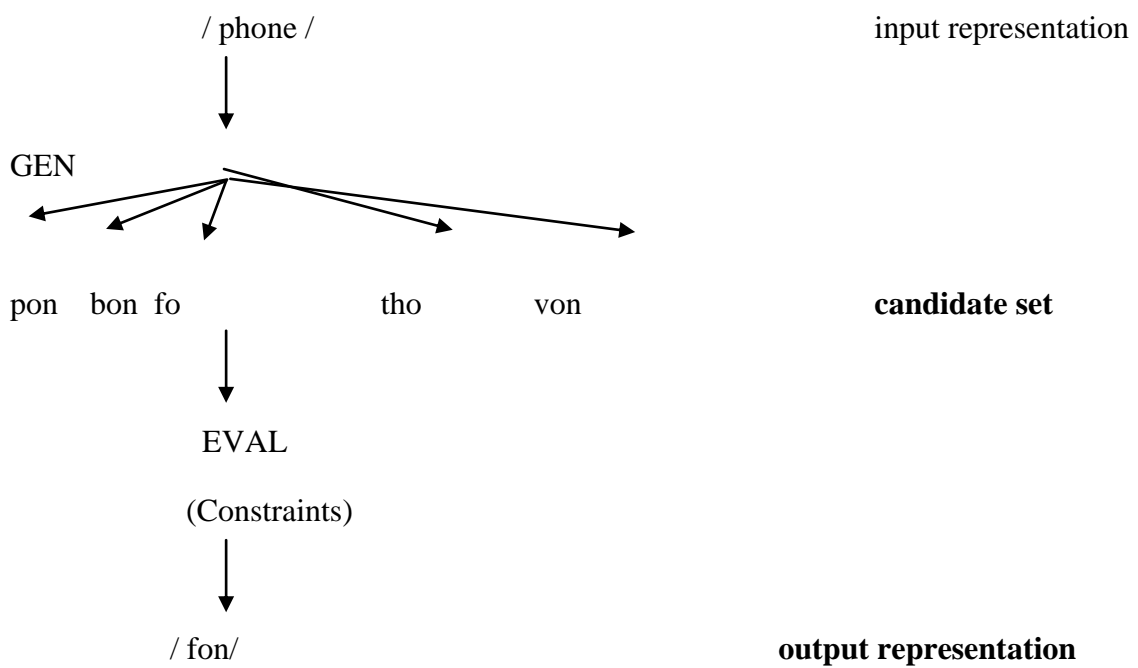


Figure 9: Schematic representation of the word phone in OT grammar



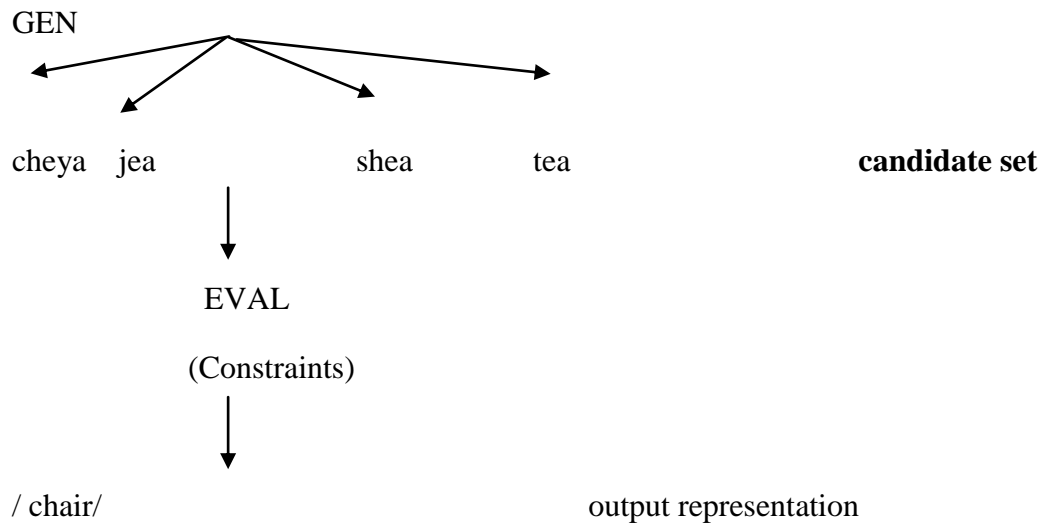


Figure 10: Schematic representation of the word chair in OT grammar

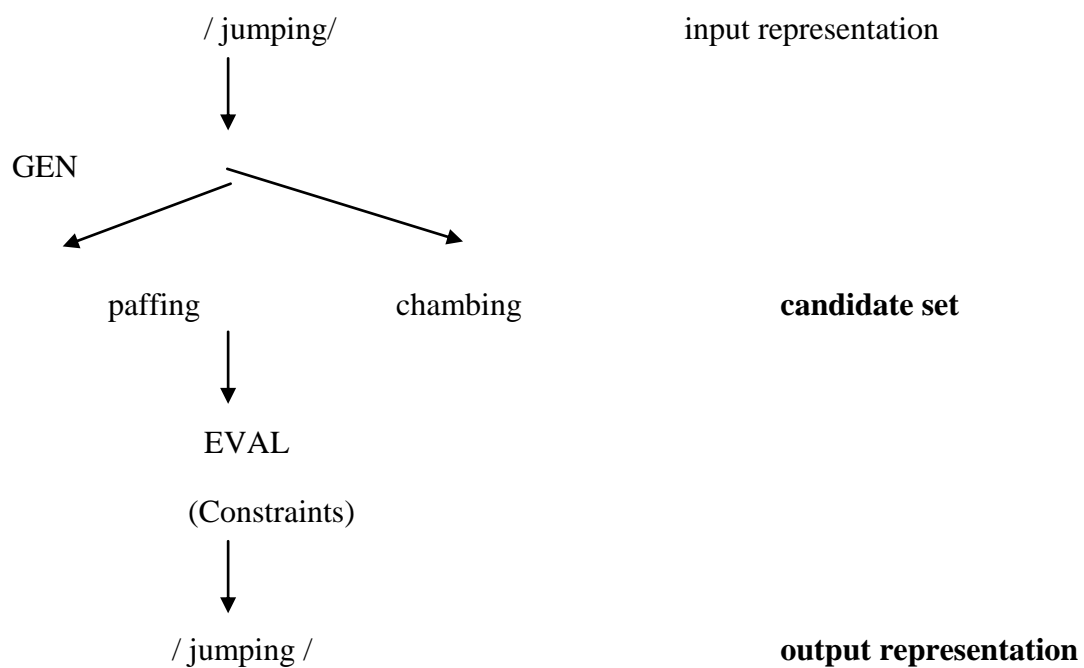


Figure 11: Schematic representation of the word jumping in OT grammar



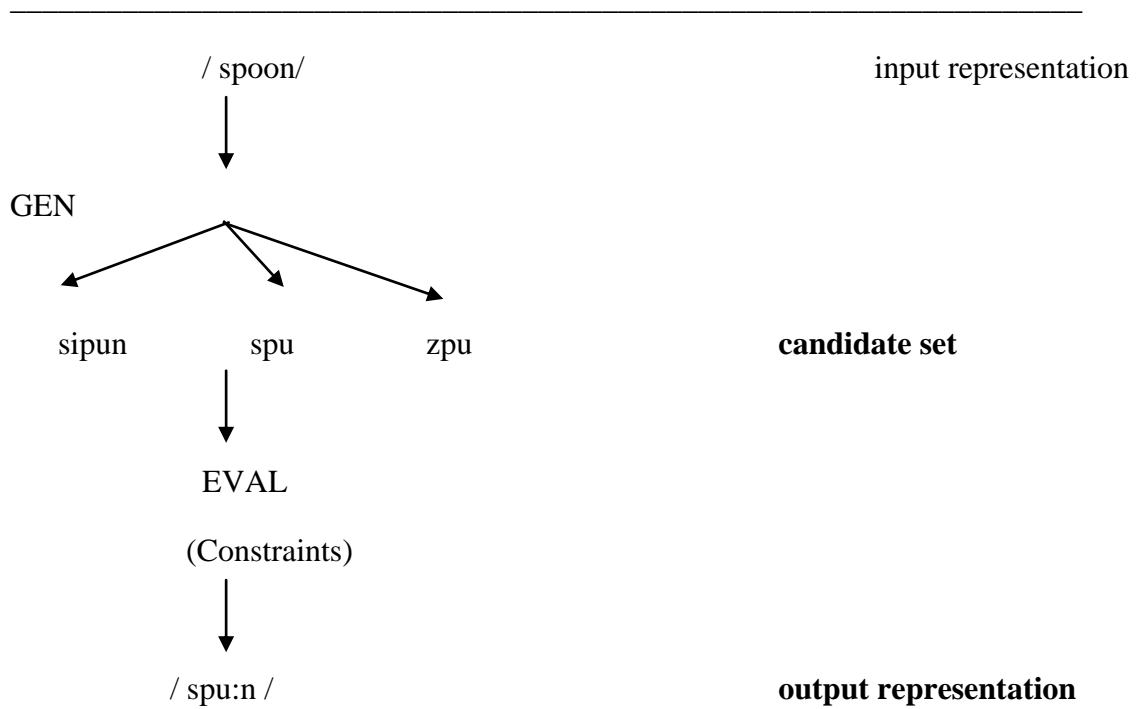


Figure 12: Schematic representation of the word spoon in OT grammar

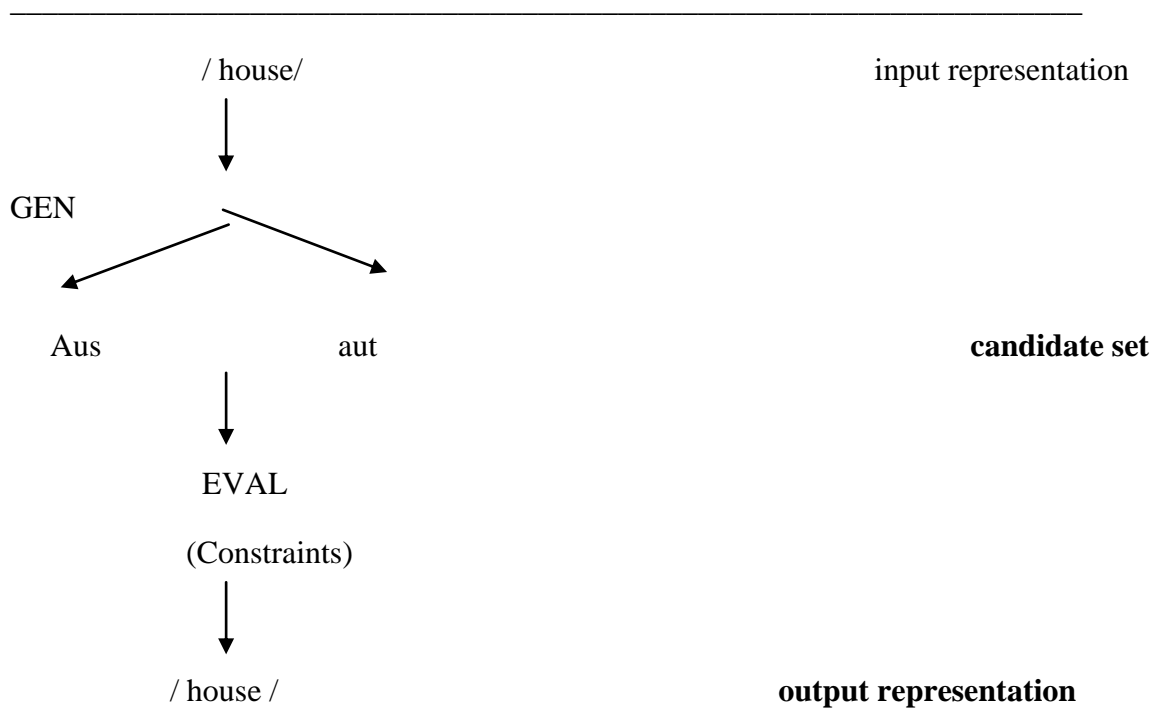


Figure 13: Schematic representation of the word house in OT grammar

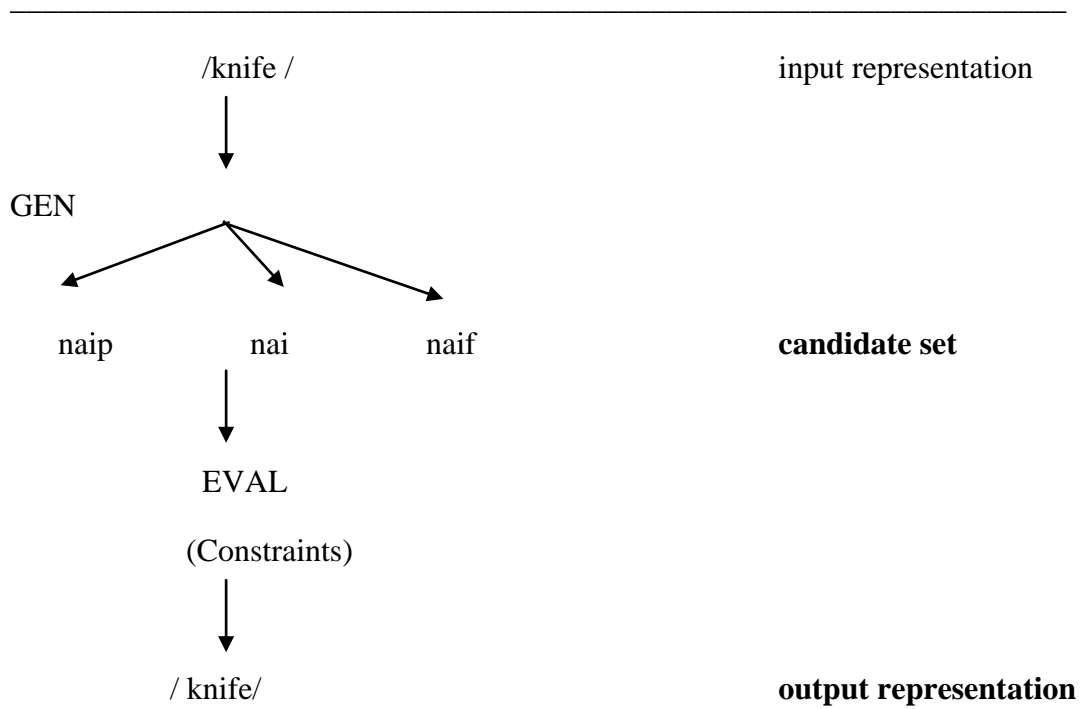


Figure 14: Schematic representation of the word knife in OT grammar

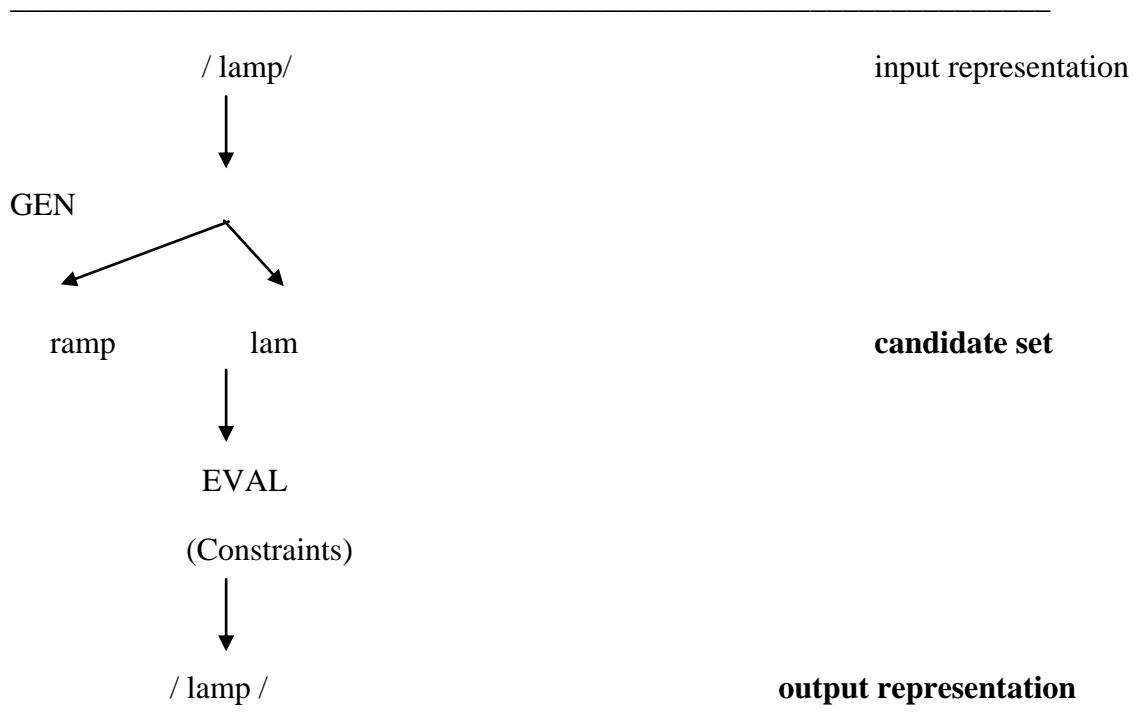


Figure 15: Schematic representation of the word lamp in OT grammar

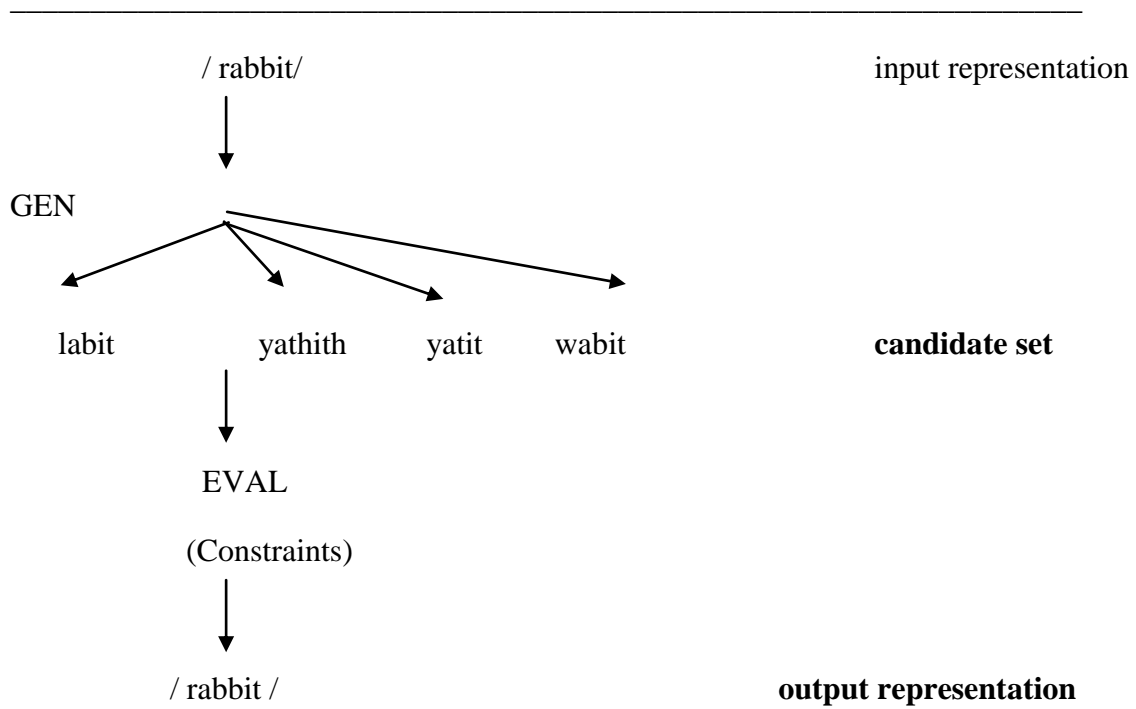


Figure 16: Schematic representation of the word rabbit in OT grammar

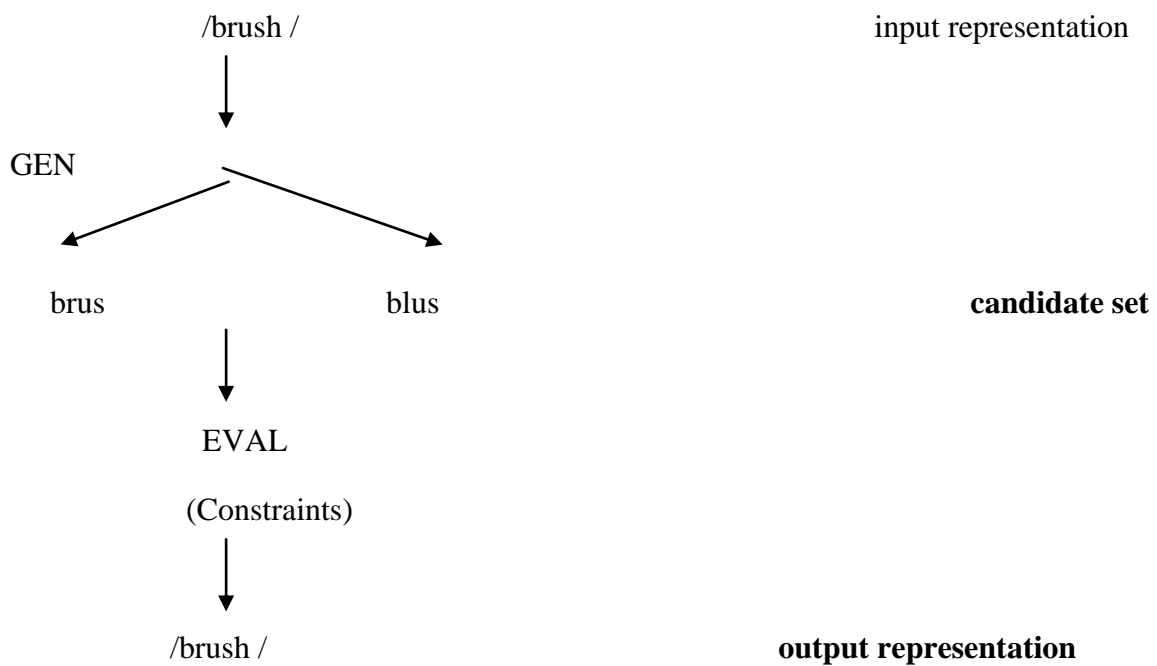


Figure 17: Schematic representation of the word brush in OT grammar

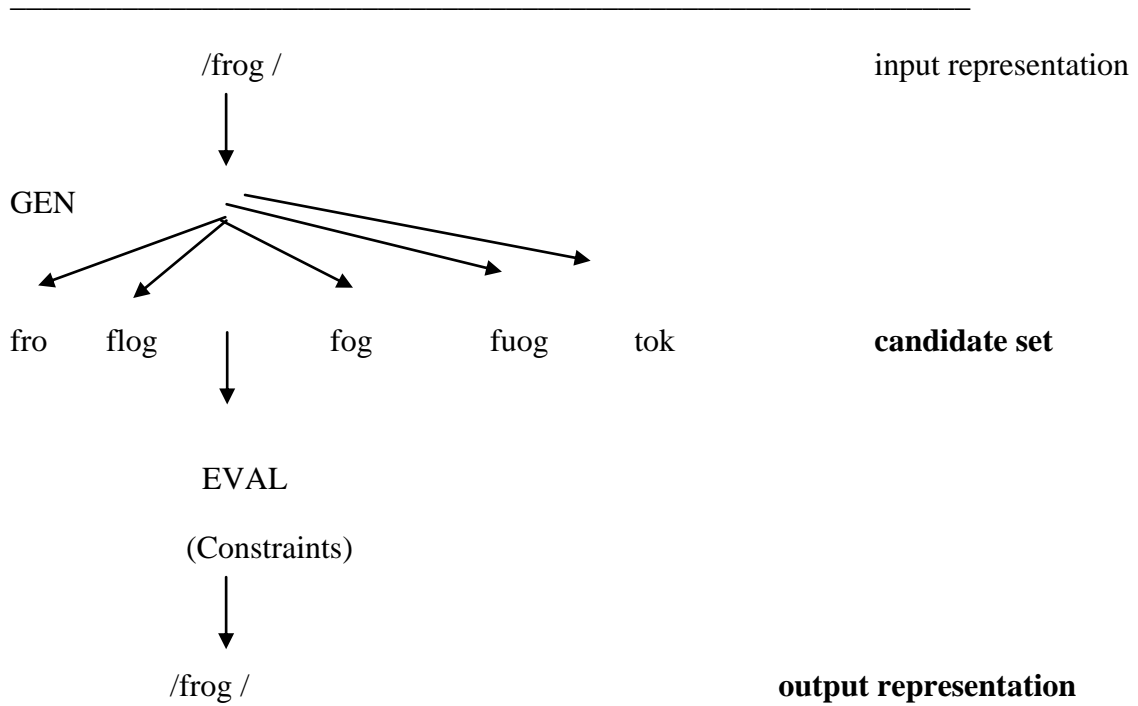


Figure 18: Schematic representation of the word frog in OT grammar

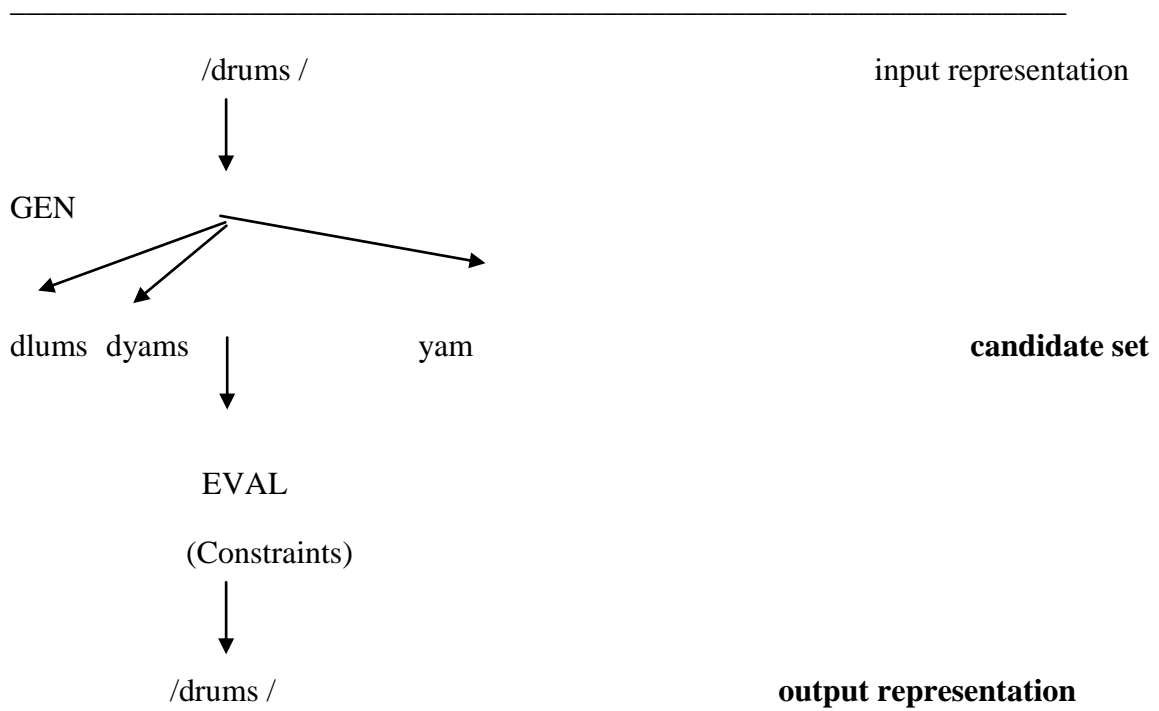


Figure 19: Schematic representation of the word drums in OT grammar

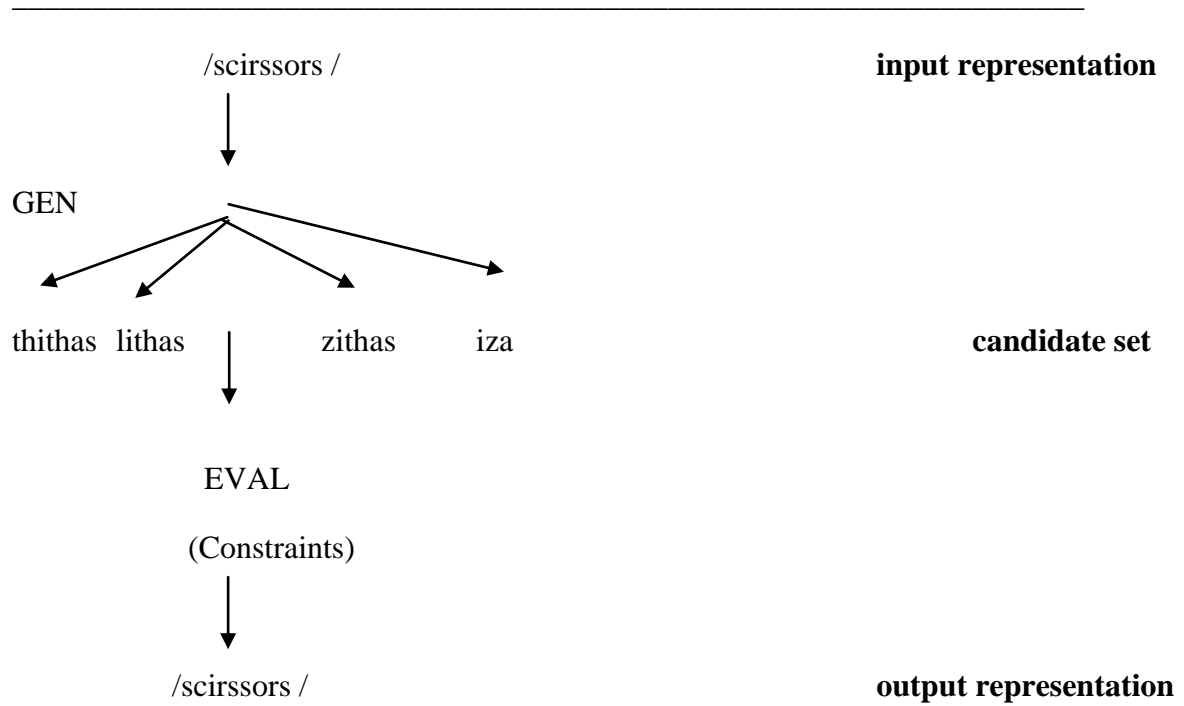


Figure 20: Schematic representation of the word scirssors in OT grammar

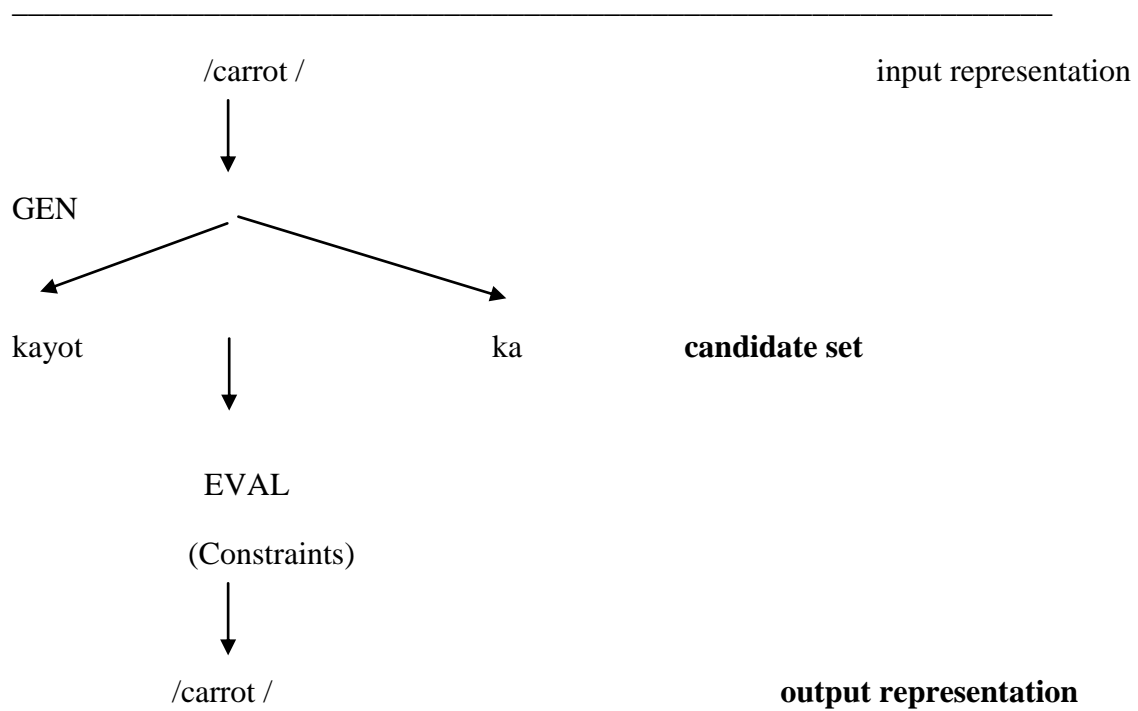


Figure 21: Schematic representation of the word carrot in OT grammar

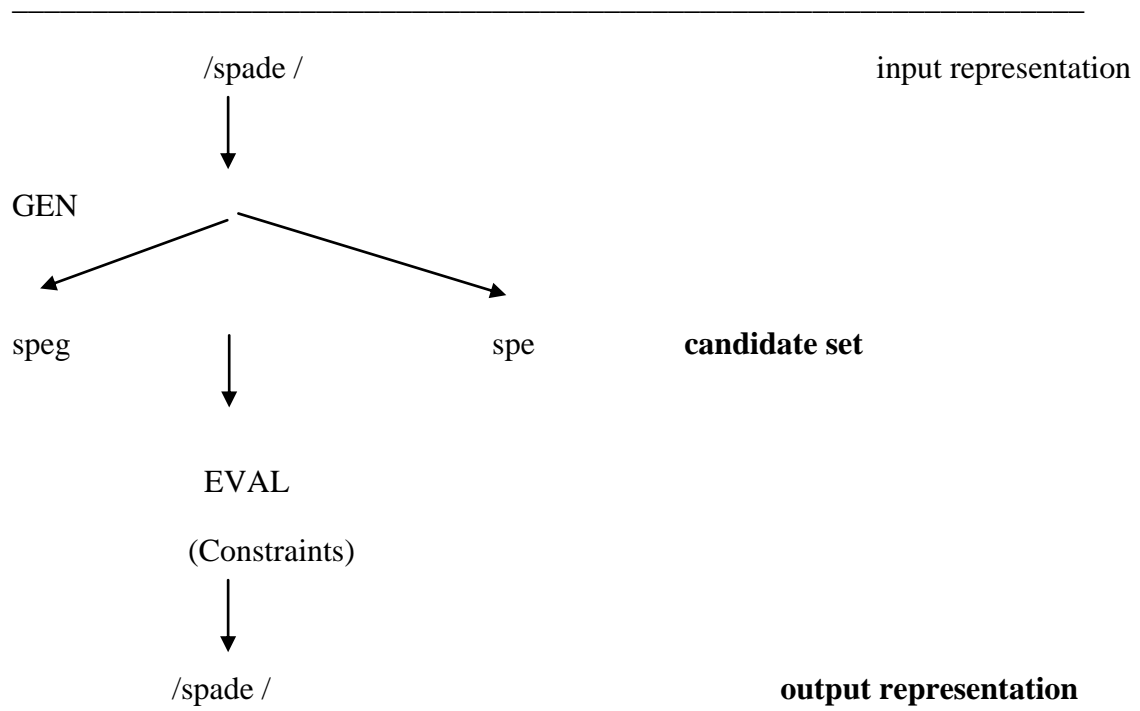


Figure 22: Schematic representation of the word spade in OT grammar

## CHAPTER FIVE

### SUMMARY, CONCLUSION AND RECOMMENDATION

#### 5.1 Introduction

This chapter consists of summary, conclusion and recommendation

#### 5.2 Summary of findings

Formal theories of language have been central in shaping our understanding of the acquisition process, whether normal or disordered. The assumptions and claims of these models vary widely, often leaving open the question of a theory's explanatory adequacy. In this regard, a well-defined set of criteria have been advanced to evaluate the dual adequacy of any linguistic theory as also a theory of phonological acquisition. Specifically, OT is an adequate theory of phonological acquisition because in this study it has at least accounted for the following:

The actual facts of learners's productions and the mismatches between a child's output and the adult input forms; the generalities that span learners's sound systems, as well as associated variability within and across developing systems; and the changes that occur in learners's grammars over time. In achieving these goals, an adequate theory must also remain testable and falsifiable.

In this section we present a summary on articulation and phonological impairments found in the speech of learners with Cerebral Palsy learning English as a second language.

##### 5.2.1 Articulation impairments

The speech of learners learning English as a second language is characterised by omissions, substitutions, distortions and insertions. Omissions involved a deletion of a phoneme in initial, medial or final position of a word. Omissions are observed to occur in final positions of words as compared to initial and medial positions. The most affected category of consonants were plosives.

Substitutions involved a replacement of a consonant with another. In this study substitution involved manner of production. Plosives were mainly substituted with fricatives. There was substitution of voice which involved the plosives [p] and [b] in initial position. Place of

articulation/production also underwent substitution which involved the substitution of palatoalveolars with labiodentals.

Distortions involved realizations that though remained within the target phoneme, they involved an addition of a consonant. Notably distortions involved an addition of a bilabial before the target phoneme. Despite the target phoneme being realised as it is, it was accompanied by a bilabial example the word phone was realised as “mbon”

Insertions involved an addition of a vowel in consonant cluster examples for the words blue, tree and girl.

### **5.2.2 Phonological impairments**

Phonological impairments were categorised into identifiable patterns that include consonant deletion, cluster reduction, syllable reduction, fronting, deaffrication and stopping.

Consonant deletion involved a deletion of a consonant in initial, medial or final positions. In this study consonant deletion occurred mostly in initial position of words as compared to medial and final positions, a finding that is different from studies done in English speaking countries.

Cluster reduction involved a deletion of a segment from a consonant cluster. The consonant clusters that were used in this study were pl, bl, tr, sp, sw, gr, fl, br, dr, kr, and tl all the consonants are found in initial position of the words except for tl which is found in final position for the word little. From the consonant clusters the following were the findings:

In a consonant cluster involving a fricative and a plosive, the fricative was deleted. Therefore the consonant reduction affected fricatives a s compared to plosive. The consonant clusters underwent error patterns that were categorized as reductions and substitutions. Whereas reductions involved the target consonant cluster being realized as a consonant (for example, /fr/ → [f] in the word frog which was pronounced as [fog] and /blue/→[b/ as in the word [blue] which was pronounced as [bu].

Substitutions saw the target consonant cluster being realized as another totally different consonant or another consonant cluster altogether. (for example, /thr/→[c]). A comparison of the percentages between reductions and substitutions show reductions being the most common error pattern as compared to substitutions in this study.



In this study syllable reduction involved the deletion of a syllable from a word containing two or more syllable. This deletion was found to have occurred in the unstressed syllable. Data from this study shows that some segments in the output underwent sound changes whereby one sound class replaced another class of sounds. In this study two phonemes /l/ and /r/

The error pattern involved dorsal segments being replaced by coronal that is the substitution of sounds in the front of the mouth, usually alveolar, for velar or palatal sounds. In this study three phonemes /k/, /g/ and /b/ were observed to undergo this impairment.

Deaffrication involved the deletion of a stop component from an affricate leaving only the continuant aspect. Affected by this impairment were affricatives **tʃ** and **dʒ**

Lastly stopping involved the substitution of a fricative or an affricate for a stop consonant. In this study it was observed to be the most common of the impairment in phonological processes in the speech of the respondents with Cerebral Palsy in this study. Affected by this impairment were fricatives in final position of words.

Notably deletion appeared to be the most common pattern appearing in consonant deletion, syllable reduction, and affrication while substitution appeared in fronting and stopping. The most affected class of sounds in the speech of learners with Cerebral Palsy was fricatives

A comparison on the impairments in the speech across gender reveals that boys were most affected compared to the girls in terms of the impairments made in speech. A finding that is in agreement with studies done on Cerebral Palsy in languages such as Cantonese, Mandarin and English

### **5.2.3 Effects of articulation and phonological impairments on communication**

**Distortions.** A speech sound was found to be distorted when it sounded more like the intended phoneme than another speech sound but is conspicuously wrong. The /s/ sound, for example, was relatively difficult to produce; learners produced the word “zip” as “schleep,” “zleep,” or “thleep.” Distortions caused misunderstanding thereby reducing intelligibility.

**Substitutions.** Learners sometimes substituted one sound for another, as in saying “train” for “crane” or “doze” for “those.” Learners with this problem were often certain they had said the correct word. Substitution of sounds caused considerable confusion for the listener.

Omissions. Learners omitted certain sounds, as in saying “poon” for “spoon.” They dropped consonants from the ends of words, as in “pos” for “post.” An extensive omission problem made speech unintelligible.

Additions. The addition of extra sounds made comprehension difficult it was hard for the researcher to clearly understand what the respondent was saying. For example, a child said “buhrown” for “brown” or “hamber” for “hammer.”

#### **5.2.4 The API in relation to the cohorts**

In order to achieve the objectives of this study the sample was divided into three Cohorts

Cohort I- Mild

Cohort II – Severe

Cohort III- Acute

Cohort I: Mild

In this group of respondents, their speech was characterized by few or less Articulation Phonological Impairments.

Cohort II: Severe/ Moderate

In this group of respondents, the speech was characterized by many of the Articulation Phonological Impairments majority of the respondents fell in this category.

Cohort III: Acute

In this group of respondents the speech in characterized by no response for majority of the linguistic tasks offered to the respondents. The learners in this category were classified as having speech which is unintelligible and also slurred. How is this information useful?

To Parents

Because learners with cerebral palsy are at greater risk for language disorders, it is important to have your child's language skills assessed at an early age (preferably by age 2).

Language stimulation should be part of your child's overall early intervention program. Early language intervention and the establishment of a consistent way for your child to communicate (speech, alternate communication system, i.e. manual sign, photographs,

picture communication symbols or PCS, low tech voice output communication aids or VOCA's) will provide a good foundation for learning to read and write and for participating in classroom discussions.

#### To Service Providers

Because of the relative strength of vocabulary skills, building these skills can help facilitate the use of augmentative communication devices and the onset of reading skills.

Learners with cerebral palsy may experience multiple sensory, physical, visual, and cognitive deficits. The relative strengths and weaknesses in these areas are different for each child. Assessment and intervention procedures should reflect these learners differences

Careful assessment in each of the language, motor, cognitive, and sensory areas is needed to create learners profiles of performance for learners with cerebral palsy

In depth assessment in multiple developmental (language, cognition, and motor) will aid in planning the best academic programs possible for learners with cerebral palsy.

Language intervention programs should provide opportunities for learners to communicate through alternate means, and numerous opportunities to express concepts. Providing these opportunities as early as possible facilitates both language learning and advancement in academic subjects

#### To Researchers

Researchers are encouraged to gather information on language development along with motor or cognitive functioning in order to better understand the interrelationships between the development of motor, cognitive, and language skills in learners with cerebral palsy

### **5.2.5 Proposed interventions to improve communication**

From the focus group discussions the researcher was able to identify the following intervention strategies used by teachers to help the learners learning English as a second language:

Core vocabulary therapy focused on a selection of target words and used these repeatedly in clinical and natural settings (Holm, Crosbie & Dodd, 2005). This approach followed a structured programme involving teaching target words sound by sound, with additional visual

prompts, and then syllable segmentation followed by whole word practice. These words are then practised in drills daily

The Intervention involves a drill-play format (Holm et al, 2005; Paul, 2007). Drill play was chosen as it is motivating to the child while eliciting a large number of productions of the target words and sounds. The therapy activities used objects and colourful pictures to maintain the interest of the learners, and in particular toys which were noisy to encourage interest of the child with visual impairment. Families and teachers were also given the list of target words or sound and were asked to model the word at least 10 times per day.

The core vocabulary therapy approach focused on 10 target words. These were introduced randomly and two new words per week were presented, whilst the previous words continued to be focused on to encourage maintenance. This therapy was based on the research of Holm et al (2005). Only 10 words were used to ensure that the learners were not cognitively overloaded. The words chosen for each child was similar to those suggested by Holm et al (2005) and included the subject areas of

familiar people: mum, dad, names of siblings

function words: toilet, help, finish, name of AAC device

food: food, drink

places: home, school, park

favourite things: drum, guitar, puzzle

Holm et al (2005) also recommended that only two sessions per week for six/eight weeks. In this study there were four sessions per week for six weeks this was so the child received intensive treatment, as this has been seen as effective for learners with multiple disabilities (Sommers et al 1970).

The first session of each week focused on the two new target words. The two new target words were introduced as suggested by Holm et al (2005). The words were broken down into learners sounds and spoken with extra prompting by using cued articulation, for example: finish was produced as “f” “i” “n” “i” “□”

then “fi” “ni” “□”

then “fi” “ni□”

then “fini□”

The child was encouraged to repeat each sound, then syllable and finally whole word.

Phonetic placement and cued articulation were used as prompts and where possible and

appropriate the word was signed using Makaton (1998). Semantic cues or imitation was used if the child did not label the object or symbol to encourage elicitation. Some of the words were less motivating than others such as “toilet” compared to “guitar”.

The articulation therapy approach involved focusing on one phoneme at a time and progressed from listening to production in isolation to using the phoneme in everyday speech. This was deemed the most appropriate form of therapy as the learners had very limited phonetic repertoires which do not appear to follow the developmental norms as cited in Van Riper and Erickson (1996). The key steps in the articulation therapy were as follows:

#### *Auditory discrimination*

The child was introduced to the target sound to be worked on such as [f] by giving them the object cue (a toy fish) and then being told what the sound was. They were then introduced to another object (ball) which represented a contrasting sound such as [b]. Learners were instructed to listen for the target sound and identify the object that represented the sound. Feedback was given and the child was directed to the correct object.

#### *Production of the sound in isolation*

Phonetic placement therapy (PPT) and cued articulation were used to encourage the child to produce the target sound in isolation. PPT consists of teaching where the lips, teeth and tongue should be positioned when making a sound (Bleile, 1995). Bleile describes that the researcher can modify the techniques by using items such as food to encourage correct positioning. An example of phonetic placement with [f] is: “*Instruct the client to touch his or her lower lip with the bottom of the upper front teeth and then to blow, which often results in [f]. In more severe cases, move the client’s lip to the correct positions using a finger or tongue depressor. Alternatively, instruct the client to “bite” the lower lip with the upper teeth and then to blow.*” (Bleile, 1995, pg 324)

Cued articulation (Passy, 1990) was designed to facilitate production of sounds by using simple hand cues. An example of a cued articulation of [f] is used with photos of the index finger of the right hand between the lips and the chin. It is described as:

*“As the /f/ is articulated the shape of the hand remains the same but is moved downwards and forwards for approx. four inches (10cm). Then movement of the hand shows the air is continuing out of the mouth to produce this sound”* (Passy, 1990, pg 18).

The target sound was described using phonetic placement and then the hand cue for the target sound was shown. The child was encouraged to do this with hand over hand assistance to begin with. Cued articulation was used to give the child an indication of what sound was being made, however if they were aversive to this due to oral defensiveness this was reduced and auditory cues were relied upon.

Once the child had been introduced to the target sound they were encouraged to imitate the sound up to 10 times and games were played to increase the number of times the sound was spoken. If the child found it difficult to produce the sound they were given encouragement to try it again; such as “that was a good try, now try and put your top teeth on your bottom lip to hide it and then blow”.

#### *Production of sound in consonant vowel (cv) and cvcv sequences*

When the child was able to produce the sound in isolation they were encouraged to produce it in a cv sequence, such as [fa], [fi]. At first the two sounds were separated to ensure that the child could make these sounds. The child was then encouraged to put the sounds together. The activities that were used for the sound in isolation were used for the sound in a cv combination. If the child was then able to become consistent with cv combination, vc such as [if] [ɪf], and cvcv, such as [fɪmɪ], were attempted. If the child was able to say a word she or he was encouraged to fill in the space in songs using the cv or vc or cvcv word. None of the learners were able to move on from this stage during intervention.

The teachers acknowledged that though they are supposed to have therapy sessions away from normal classroom teaching they do it in class to learners pupils since there is no ample time set aside in the syllabus for speech therapy.

### **5.3 Conclusion**

The current study set out to identify articulation and phonological impairments in the speech of 6-14 year old learners of English as a second language. It was revealed as follows:

1. The articulation impairments found in the speech of the learners were omissions, substitutions, distortions and insertions
2. The phonological impairments found in the speech of the learners were consonant deletion, cluster and syllable reduction, fronting, deaffrication and stopping

3. The effect of the articulation and phonological impairments brought misunderstanding ,confusion and intelligibility problems on the listener
4. The proposed interventions for the learners were core vocabulary and articulation therapy

Therefore, the findings of this study have implications for linguists, speech language therapists, educators and early child development practitioners.

#### **5.4 Recommendations**

There is a need for further research as there are a limited number of studies which focus on providing speech and language therapy for learners with Cerebral Palsy here in Kenya. This research has shown the articulation and phonological abilities of second language learners of English suffering from Cerebral Palsy.

A study on the intervention strategies and therapy would be important. It would be useful to see if a combination of therapies could be implemented and be successful. Therefore it would be important to continue the research into this as it has been reported that AAC only is not always supported by families as they prefer to use the child's verbal output and fear that AAC may stop them talking (Beukelman & Mirenda, 2005). Including the use of AAC with articulation therapy and core vocabulary therapy could improve not only the child's speech as has been found previously (Millar et al, 2006) but also to encourage the views of families with learners who use AAC.

Articulation therapy has been seen in this study and in others (Marchant et al, 2008; Wu & Jeng, 2004) to have a positive impact on the phonetic repertoire of learners with CP. Core Vocabulary therapy has also had a positive impact on all of the learners. Future research into both these areas is essential to discover what implications are for learners with Cerebral Palsy. This should also include assistive technique such as cued articulation and phonetic placement.

This study further proposes the following areas for further studies:

There is need to look at the speech impairments of learners with Cerebral Palsy in Kenyan languages other than English. This will help build on literature on speech disorders and language acquisition.

This study examined consonants in the speech of learners with Cerebral Palsy therefore a look at vowels will also provide insight into the speech characteristics of Cerebral Palsy speech.

The study only examined single words in isolation elicited through a picture naming task. A study on the words in sentences would provide insight into disorders prevalent in spontaneous speech.

In this study the learners with Cerebral Palsy were unable to produce all the consonants of target English. Their unintelligible speech is characterized by a reduced segmental inventory. Their inventories included nasals, stops and glides, but not at all places of articulation, while fricatives were most affected. Despite their unintelligibility, there is need to use conventional descriptive linguistic techniques in examining the occurrence, distribution and contractiveness of sounds, this would establish if learners with disorders have a highly systematic phonology, complete with phonetic and phonemic inventories, phonotactic constraints, and contextually governed sound system. A study with specific reference to segmental, featural and syllabic levels of structure is prudent. Such a study will not only aid in intervention but also treatment of more complex linguistic structures yielding the greatest phonological gains for the learners with articulation and phonological impairments.

### **5.5 Problems in the study**

Problems of collecting data from cerebral palsy learners included a short concentration in some learners, exhausting from speaking at long period and sudden-involuntary body movements such as jerking, drooling and spasm. Moreover, some cerebral palsy learners had a problem of coming up with words even after being given verbal cues from the researcher. Financial constraints were also another problem since the researcher was unable to obtain funding and grants from relevant institutions.



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## APPENDICES

### APPENDIX I: FOCUS GROUP DISCUSSION

#### Introduction

My names are Victor Makuto, I am a PhD student in the department of languages, linguistics and literature Egerton University - Njoro. Thank you for agreeing to participate. I am interested to hear your valuable opinion on how Cerebral Palsy as a condition affects the way learners communicates. The purpose of this study is to examine the speech characteristics of learners with Cerebral Palsy. We hope to learn the various ways that we can help or recommend for learners affected by this condition to become effective communicators.

The information you give me is completely confidential, your input and contribution in this focus discussion group will be used solely for the achievement of the objectives of this study and not for any other purpose whatsoever not relevant to this study.

In order to capture the thoughts, opinions, and ideas we hear from the group and for purposes of quick retrieval of information shared in this forum, our discussions will be tape recorded. We understand how important it is that this information is kept private and confidential and so all the information here will be treated as such.

#### Questions

What are your names/ please introduce yourselves

What is the linguistic background of the learners you take in this school?

How do you grade the learners affected

What is the basis or criteria of grading the students in a language class?

Generally in what ways has Cerebral Palsy as a condition affected the learners you teach

In what specific ways has this condition affected the pupils within a language class?

How do learners with this condition speak?

Describe the way learners with Cerebral Palsy speak

In your own opinion as a teacher what are the deficiencies speech of learners with Cerebral Palsy

Which sounds do the learners have a problem in pronouncing

Which words do the learners have a problem in pronouncing

Where do the problematic sounds occur in the speech of learners with this condition

How is communication affected by this condition?

For this special group, how do you teach speaking skills in this class of learners

Which difficulties do these learners have when speaking?

Which recommendations do you suggest to help these learners become effective communication

Which strategies do you employ to remedy articulation impairment

Describe each in details giving an example

How effective are the strategies that you employ on the learners.



## APPENDIX II: LANGUAGE TASKS

### Respondent Information

Name: \_\_\_\_\_

Gender: \_\_\_\_\_

Class: \_\_\_\_\_

Primary Language: \_\_\_\_\_

Age Calculation	Year	Month	Day
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Birth Date:	_____	_____	_____
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Test Date	_____	_____	_____
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Chronological Age:	_____	_____	_____
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This test provides information about a child's articulation ability by sampling both spontaneous and imitative sound production.

### Section I Single words

This section includes 60 target words that gather information on 77 consonants and consonant cluster sounds. This allows the respondents to respond to picture plates and verbal cues from the examiner with single-word answers that demonstrate common speech sounds on all the English phonemes covering the three areas of articulation that is initial, medial and final position within a word.

Section I Single words -Sounds in words

	Target		Sound Position		
	Sounds and words		Initial position	Medial position	Final position
W	p	Pencil			
		Cup			
O	b	Boy			
		mobile			
R		Banana			
		Blue			
D	t	Tree			
		Carrot			
S	d	Spade			
		Duck			
I	k	Cup			
		Car			
N	g	Girl			
		Frog			
S	f	Phone			
		Knife			
E	v	Vehicle			
		Watch			
N	ʃ	watches			
		Chair			
C	dʒ	Orange			
		Pyjama			

	jumping			
s	Spoon			
	House			
z	Zip			
	scissors			
h	House			
η	Swimming			
	Ring			
	Feather			
	Bath			
m	Monkey			
	swimming			
n	Knife			
	banana			
	Green			
l	Lamp			
	Little			
	Pencil			
	Flowers			
	ballons			
r	Rabbit			
	Carrot			

		Brush			
		Drums			
	w	Window			
		Wheelbarrow			
	y	Yellow			
		Fishing			
		Fish			

Score sheet sounds in words

**Pencil** /pensl / \_\_\_\_\_ **Cup** /c^p/ \_\_\_\_\_ **Boy** /bɔi/ \_\_\_\_\_

**Mobile** /məubi:l/ \_\_\_\_\_ **Banana** /bənana/ \_\_\_\_\_ **Blue** /blu:/ \_\_\_\_\_

**Tree** /tri:/ \_\_\_\_\_ **Carrot** /kærət/ \_\_\_\_\_ **Spade** /speid/ \_\_\_\_\_

**Duck** /d^k/ \_\_\_\_\_ **Car** /ka:/ \_\_\_\_\_ **Girl** gɜ:l \_\_\_\_\_

**Frog** /fræg/ \_\_\_\_\_ **Phone** /fəʊn/ \_\_\_\_\_ **Knife** /naɪf/ \_\_\_\_\_

**Watch** /wətʃ/ \_\_\_\_\_ **Chair** /tʃea/ \_\_\_\_\_ **Orange** /arɪndʒ/ \_\_\_\_\_

**Pyjamas** /pɑdʒamaz/ \_\_\_\_\_ **Jumping** /dʒ^mpɪŋ/ \_\_\_\_\_ **Spoon** /spu:n/ \_\_\_\_\_

é

**House** /haʊs/ \_\_\_\_\_ **Zip** /zɪp/ \_\_\_\_\_ **Scissors** /sɪzəz/ \_\_\_\_\_

**Ring** /rɪŋ/ \_\_\_\_\_ **Feather** /fe/ \_\_\_\_\_ **Bath** \_\_\_\_\_

**This** /this/ \_\_\_\_\_ **Monkey** /m^nki/ \_\_\_\_\_ **Swimming** /swimiŋ/ \_\_\_\_\_

**Knife**/naïf/ \_\_\_\_\_ **Banana** /bənənə/ \_\_\_\_\_ **Green** /gri:n/ \_\_\_\_\_

**Lamp** /læmp/ \_\_\_\_\_ **Little** /litl/ \_\_\_\_\_ **Flowers** /fləʊə/ \_\_\_\_\_

**Balloon** /balun/ \_\_\_\_\_ **Rabbit** /ræbit/ \_\_\_\_\_ **Brush**/ br^/ \_\_\_\_\_

**Drums** /dr^mz/ \_\_\_\_\_ **Window**/windəʊ/ \_\_\_\_\_ **Wheelbarrow** /wilbærəʊ/ \_\_\_\_\_

**Yellow** \_\_\_\_\_ **Fishing** \_\_\_\_\_ **Fish** \_\_\_\_\_

### APPENDIX III: DATA ELICITATION PICTURES

#### Household appliances and Utensils

 <p>Cup</p>	 <p>Plate</p>
 <p>Knife</p>	 <p>Cooking stick</p>
 <p>Pot</p>	 <p>Chair</p>
 <p>Sufuria</p>	 <p>Spoon</p>

#### Environment and Clothing

 <p>Bicycle</p>	 <p>Dress</p>
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Water



Tree



Basket



Shoes



Walking stick



Short trousers



House



Door

Domestic animals and Birds



Cow



Goat



Sheep



Dog



Hen



Bird



Cock



Chick



Calf



Snake



Fish



Foodstuff



Ugali



Bananas



Maize



Cabbage



Beans



An Egg



Potatoes



Vegetables



Flour










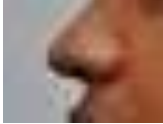






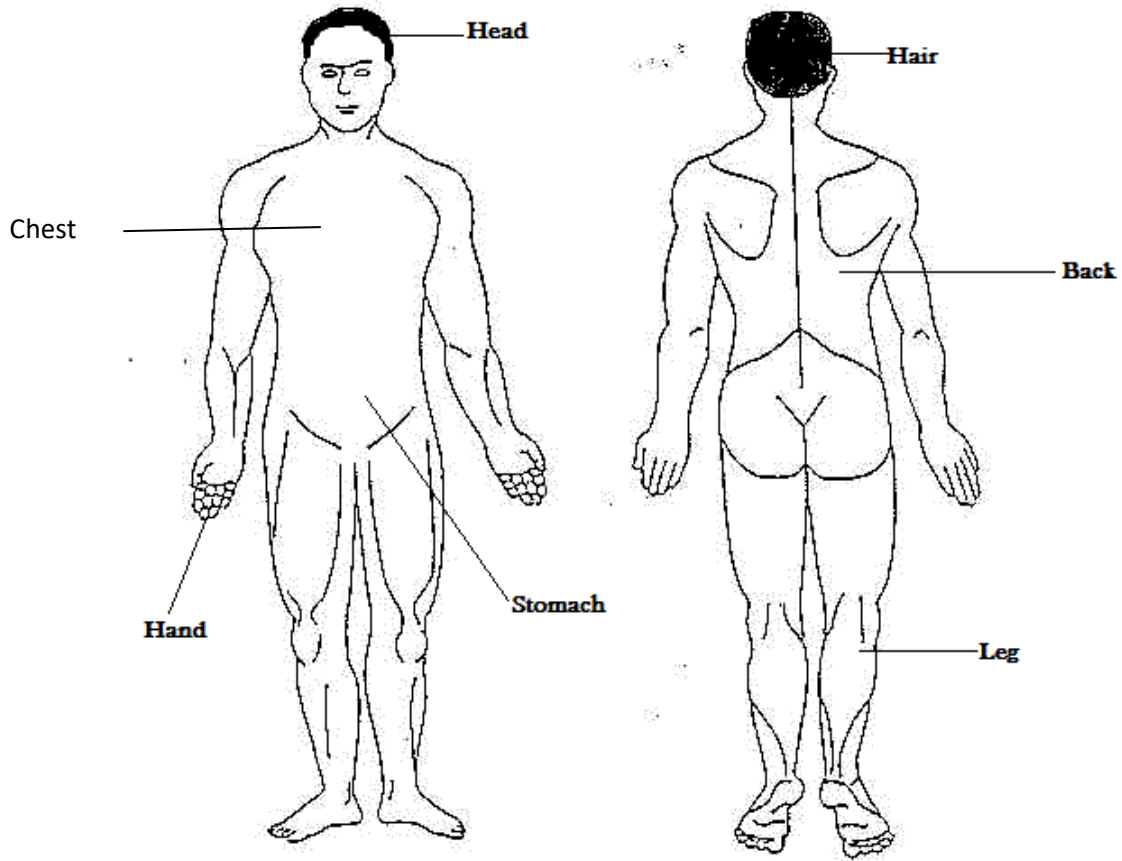
Millet



Milk

People and Body parts

 <p>Father</p>	 <p>Mother</p>
 <p>Grandfather</p>	 <p>Grandmother</p>
 <p>Boy</p>	 <p>Girl</p>
 <p>Ears</p>	 <p>Tongue</p>
 <p>Stomach</p>	 <p>Nose</p>
 <p>Mouth</p>	 <p>Hands</p>
 <p>Head</p>	 <p>Hair</p>



For the pictures the researcher showed them to the respondents and asked them questions such as:

What is this?

What do you call this?

What are they doing?

Which colour is it?

What is the boy doing

What is the child doing?

## APPENDIX IV: RESEARCH PERMIT



### NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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Ref. No.

Date  
**1<sup>st</sup> May, 2014**

**NACOSTI/P/13/8672/356**

Victor Molenje Makuto  
Egerton University  
P.O Box 536,  
**NJORO**

#### **RE: RESEARCH AUTHORIZATION**

Following your application for authority to carry out research on '*Articulation and phonological impairments in the speech of second language learner with cerebral palsy*,' I am pleased to inform that you have been authorized to undertake research in **Kisumu County** for a period ending **31<sup>st</sup> May 2015**.

You are advised to report to **the County Commissioner and County Director of Education, Kisumu County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

**DR. M.K RUGUTT, PhD, HSC.**  
**DEPUTY COMMISSION SECRETARY**  
**NATIONAL COMMISSION FOR SCIENCE , TECHNOLOGY & INNOVATION**

Copy to:  
The County Commissioner  
The County Director of Education  
Kisumu County

*National Commission for Science, Technology and Innovation is ISO 2008, 9001 Certified*