Demuth, K. 1993. Issues in the acquisition of the Sesotho tonal system. *Journal of Child Language* 20, 275-301.

Issues in the Acquisition of the Sesotho Tonal System[*]

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ABSTRACT

This paper examines the acquisition of the grammatical tone system of Sesotho, a southern Bantu language where tone sandhi is rich, and where surface and underlying representations are often quite distinct. Results of the longitudinal case study show that rule assigned tone on subject markers is generally marked appropriately by 2 years. In contrast, underlying tonal representations on verb roots are learned gradually over time, showing an early Default H tone pattern. The study also finds that, while some tone sandhi rules are in the process of being acquired between 2;6 and 3 years, problems in the mapping between tonal representations and segments persist. The paper raises methodological and theoretical issues not only for the acquisition of tonal systems, but for the acquisition of phonology in general.

INTRODUCTION

The development of autosegmental phonology (Williams, 1971; Leben, 1973; Goldsmith, 1976) represents one of the most important advances in phonological theory since the generative insights of The Sound Pattern of English (SPE) (Chomsky & Halle, 1968). In particular, it has contributed greatly to the understanding of non-linear problems which had previously eluded traditional segmental analysis. Indeed, autosegmental approaches to phonology developed, in part, from attempts to capture the systematic yet apparently complex grammatical tone systems which are characteristic of many African languages. More recent developments in metrical phonology (Liberman & Prince, 1977; Hayes, 1982), lexical phonology (Mohanan, 1982, 1986; Kiparsky, 1982, 1985; Pulleyblank, 1986) and prosodic phonology (Selkirk, 1984; Nespor & Vogel, 1986) continue to provide powerful tools for researching both phonological and prosodic phenomena.

The field of acquisition has been slow to adopt and integrate new perspectives from theoretical phonology, much the same as it has been slow to adopt and apply theoretical

insights in the area of syntax. Much work on the acquisition of phonology has utilized a segmental approach based primarily on insights from structural linguistics (Jakobson, 1941/1968) or SPE (Smith, 1973), though early work influenced by the Firthian School of Prosodic Phonology (e.g. Waterson (1971)), and more recent work by researchers such as Kiparsky & Menn (1977), Spencer (1986), Waterson (1987) and others signal the beginning of a new era in the study of phonological aspects of acquisition. Much of the research conducted on the acquisition of tone took place before the full development of autosegmental phonology and focused on lexical tone languages such as Thai (Tuaycharoen, 1977), Mandarin (Chao, 1973; Clumeck, 1977; Li & Thompson, 1977) and Cantonese (Tse, 1978). Since the late 1970's there has been little work on the acquisition of tone, and no comprehensive study of the acquisition of a complex grammatical tone system like that found in many African languages. More recently several researchers are beginning to address the acquisition of tone in African languages in a more systematic fashion (e.g. Moto, 1988; Demuth, 1989, 1991; Chimombo & Mtenje, 1989; Suzman, 1991), raising questions that have implications for both acquisition and linguistic theory.

The present study develops an autosegmental account of the acquisition of grammatical tone in Sesotho, a southern Bantu language spoken by approximately 4 million people in the countries of Lesotho and South Africa. After outlining the Prosodic Acquisition Problem and providing a brief introduction to the Sesotho tonal system, the paper focuses on the acquisition of Sesotho tone at underlying and lexical levels of phonology. The paper concludes with a review of the empirical findings and their import for both acquisition and linguistic theory.

The prosodic acquisition problem

Although the acquisition of prosodic phenomena such as stress, intonation, and tone is in many respects similar to the acquisition of segments (both have discrete units, and both participate in phonological rules), prosodic phenomena differ in that they must be mapped onto segments. Although this problem is relatively trivial in lexical tone languages like Mandarin, where underlying and surface tones are often the same, the problem is more serious in grammatical tone systems like that found in many Bantu languages, where abundant tone sandhi, or permutation of underlying tones, provides a serious challenge for the language learner.

In order to address the Prosodic Acquisition Problem we need to have a model or theory of what prosodic systems, or in this case tonal systems, look like. In addition, that model or theory must be able to account for all the tonal phenomena we find in human language. It is only in this way that we can address the parametric differences found in different tonal systems and discover how children determine which type of system they are

learning. Although the study of tonal systems is still developing, we adopt, for the present purposes, a model of lexical phonology (Mohanan, 1982, 1986; Kiparsky, 1982, 1985; Pulleyblank, 1986) as a means for identifying important differences among tonal systems, and as a means for making specific hypotheses about the tonal acquisition process. An adapted model of lexical phonology is presented in Figure 1.
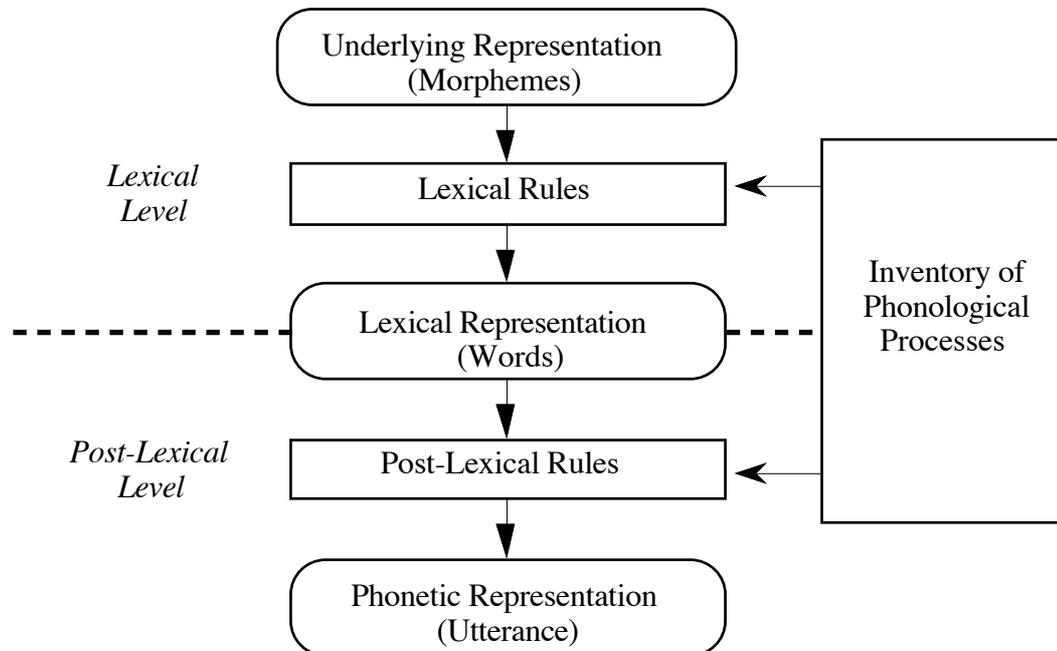
```
                    ┌─────────────────────────┐
                    │ Underlying Representation│
                    │      (Morphemes)         │
                    └─────────────────────────┘
                               │
                               ▼
  Lexical          ┌─────────────────────────┐      ┌──────────────┐
  Level            │      Lexical Rules       │◄─────│              │
                   └─────────────────────────┘      │              │
                               │                     │ Inventory of │
                               ▼                     │ Phonological │
 - - - - - - - -   ┌─────────────────────────┐ - - -│  Processes   │
                   │  Lexical Representation  │      │              │
                   │        (Words)           │      │              │
                   └─────────────────────────┘      │              │
                               │                     │              │
  Post-Lexical                 ▼                     │              │
  Level            ┌─────────────────────────┐      │              │
                   │    Post-Lexical Rules    │◄─────│              │
                   └─────────────────────────┘      └──────────────┘
                               │
                               ▼
                    ┌─────────────────────────┐
                    │ Phonetic Representation  │
                    │      (Utterance)         │
                    └─────────────────────────┘
```

Figure 1. Model of lexical phonology

The specific attraction of a model of lexical phonology is that it identifies the different levels at which phonological processes take place. Critically, those processes can be the same at different levels, and can apply more than once (i.e. cyclically) in (at least) the lexical component of the grammar. Thus, tone can be assigned 1) underlyingly, in the lexicon, 2) at the word, or lexical level, where morphemes are combined, or 3) at the postlexical level, where well formed words enter into the syntax. For English, word stress is assigned at the lexical level, and sentence (phrasal) stress and subsequent pitch contours are assigned at the postlexical level. This contrasts with lexical tone languages such as Mandarin Chinese where pitch is assigned at the underlying level, and is then subject to certain rules of tone sandhi (or tonal rules) at subsequent levels of the phonology. In many Bantu languages tone is also assigned to lexical items underlyingly, but then several tone sandhi rules may apply, some triggered by grammatical phenomena such as different tense/aspect/mood constructions, before postlexical phrasal tone rules apply. Thus, the model of lexical phonology allows us to identify (at least) three levels of phonology where tone may be assigned or modified in a given language.

Crucial to a discussion of tonal systems is a distinction between the language specific 'grammatical' uses of pitch contrasts, and aspects of pitch realization that are more 'universal'. All languages have certain 'universal' intonational properties, that is, a tendency for declination throughout the utterance and a prosodic distinction between different types of speech acts: e.g. declaratives will normally be distinguished intonationally from interrogatives. In the following discussion we maintain a distinction between the discourse 'universals' of intonation, and the language specific uses of tone, focusing the bulk of our discussion on the latter.

From what we know of the acquisition of intonation in English, it appears that some discourse and pragmatic aspects of the system are acquired early. On the other hand, other aspects of postlexical pitch assignment are not fully acquired until around 12 years (see discussion, Crystal, 1986:191). Studies of lexical tone languages like Mandarin, Cantonese and Thai uniformly report that distinctions in pitch become recognizably phonemic about the same time as, or before segments, around 1;11-2;2 years (see discussion, Clumeck, 1980; Crystal, 1986). Rules of tone sandhi, however, are acquired perhaps as late as 5 years (cf. Li & Thompson, 1977). Preliminary reports on the acquisition of tone in Bantu languages indicate that some aspects of lexical tone and tonal melodies may be acquired by 2 years (Sesotho - Demuth, 1989, 1991; Chichewa - Chimombo & Mtenje, 1989; Zulu - Suzman, 1991), but we know little about the acquisition of lexical tone rules, postlexical tone rules, or aspects of intonation. Bantu languages, many of which exhibit pitch assignment at all levels of phonology, represent some of the most complex, and therefore some of the most interesting cases for determining how tonal systems are acquired. We turn now to a discussion of the Sesotho tonal system.

THE SESOTHO TONAL SYSTEM

There have been several early descriptive studies of the Sesotho tonal system (Letele, 1955; Köhler, 1956; Kunene, 1961, 1972; Tucker, 1969; see also Doke & Mofokeng, 1957). Autosegmental treatments of the Sesotho tonal system focus on the nominal system (Khoali, 1991) and the verbal system (cf. Clements, 1988; Kisseberth, 1989; Khoali, 1991); we restrict our discussion to the latter (cf. also work on closely related Setswana (Mmusi, 1991)).

Sesotho can be described as a grammatical tone language which may be in transition toward evolving a more restricted tonal system, i.e. a system where not every syllable, morpheme, or word has to be encoded for tone in the lexicon. In other words, although it is necessary to posit High (H) tone underlyingly, it is not necessary to posit Low (L) tone underlyingly. This means that verb roots, for instance, can be specified underlyingly as having either H or Ø tone. Those syllables, or Tone Bearing Units (TBUs) that end up

with no tone specification at the surface are generally filled in with a rule of Default Low Insertion. In Sesotho, approximately half of the verb roots fall into the H tone class; recent verb borrowings (loan words) are also assigned H tone. The major issue addressed in this study is how children determine the underlying tone of verbs.

Sesotho is a pro-drop language with a basic word order of (S)V(O)   The verbal complex can be schematically expanded as in (1) and (2) below.[1]

(1)   (S) SM-(T/A)-(OM)-V-(ext)-M (O)

(2)   Thabo ó-tlá-mo-rék-él-a dijó
        1T. 1SM-FUT-1OM-buy-BEN-IN 8food
        'Thabo will buy him/her food'

Although the verb *ho-réka* 'to buy' is a H toned verb, and surfaces as such in (2), there is not always a one-to-one mapping between surface structure and underlying tonal representations. For instance, if *ho-réka* 'to buy' were used with a 3rd person subject marker, which is also H toned, the first syllable of the verb would loose its high tone: *bá-reká dijó* 'they are buying food'. Likewise, the Ø toned verb *ho-batla* 'to want' can surface with a H tone on the first syllable of the verb if it is used with a H toned 3rd person subject marker: *bá-bátla dijó* 'they want food'. In other words, subject markers may influence the surface realization of tone on the following verb root. The problem for the child is to figure out, given these variable surface tone realizations, what the underlying lexical tone of a verb root may be.

Although Sesotho makes use of several basic grammatical Tonal Melodies, dependent on the tense/aspect/mood of the construction, we restrict the present discussion to the examination of the affirmative present and futures *-tla-* and *-ea-*, focusing on tonal phenomena that apply at underlying and lexical levels of the phonology. After a brief discussion of lexical tone assignment to verb roots, we discuss rule-assigned tone on

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[1] Glosses are as follows: BEN = benefactive, CONJ = conjunction, DEM = demonstrative pronoun, FUT = future tense, ext = verbal extensions, IN = indicative, LOC = locative, M = mood, O = lexical object, OM = object marker, PASS = passive, PERF = perfective aspect, PN = independent pronoun, POSS = possessive, PREP = preposition, PRES = present tense, S = lexical subject, SM = subject marker, T/A = tense/aspect, V = verb root, ´ = high tone, + = mid tone, low tone = unmarked. Numbers indicate the noun class to which different nouns belong (e.g. *motho* 'person' (and other singular human nouns) = noun class #1, *batho* 'people' (and other plural human nouns) = noun class #2, *dijo* 'food' = noun class #8, etc.). First and second person singular/plural SMs and OMs are therefore marked as 1s/p and 2s/p respectively. A modified version of Lesotho orthography has been used.
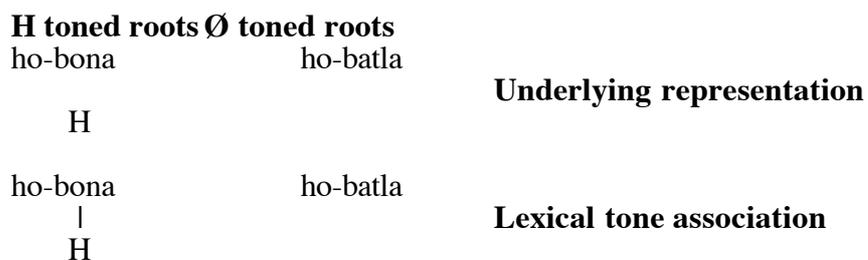
subject markers.   We then illustrate the rules of High Tone Doubling (HTD) and Obligatory Contour Principle (OCP) Effects.   An outline of the processes to be examined is listed below:

    A. *Underlying level (lexically assigned tone)*
        Verb roots
    B. *Lexical level (rule assigned tone)*
        i. Subject markers
        ii. High tone doubling (HTD)
            a. Verb roots
            b. Subject markers
        iii. Obligatory contour principle (OCP) effects
                            & tier conflation
            a. High tone delinking from subject markers
            b. High tone delinking on verb roots

Figure 2. Subset of Sesotho tonal processes

Underlying level
Lexical tone assignment to verb roots. As mentioned above, tone on Sesotho verb roots is assigned at the underlying level. Tone is then predictably associated with the first syllable of the verb root at the lexical level. Pitch contours are subsequently realized by application of the different tone rules, depending on the Tonal Melody of the construction (i.e. its tense/aspect/mood). Although some Bantu languages make a distinction between H and L toned verb roots underlyingly, in Sesotho it is not necessary to specify H versus L, but only H versus Ø. Syllables (TBUs) left unspecified for tone at the surface are filled in with a late postlexical rule of Default Low Insertion.   This is illustrated in Figure 3., where perpendicular lines (|) = initial tone associations, slant lines (/) = tones that arise through spreading or late association, and (%) = a phrasal boundary.

H toned roots Ø toned roots
ho-bona   ho-batla
                                        Underlying representation
      H

ho-bona   ho-batla
      | **Lexical tone association**
      H

```
ho-bona              ho-batla
   | /                                  High tone doubling (HTD)
   H


ho-bona              ho-batla
|   | /              |   |   |          Default low insertion
  L   H          L   L   L


ho-bona              ho-batla
|   | /\             |   |   |          Phrasal final lowering
  L   H  L%            L   L   L


ho-bóna+             ho-batla
'to see'             'to want'
```

Figure 3. Lexical tone assignment to verb roots

The examples in the derivation in Figure 3 are relatively transparent as to their underlying tonal specification. However, as will be seen in the following section, most verbs undergo tone sandhi, or the permutation of tone, resulting in multiple surface tone patterns for a given verb root. Children learning grammatical tone languages must therefore abstract away from these surface forms in order to posit the correct underlying tone of a particular verb root. We might expect this type of lexical acquisition to be a difficult process, taking place gradually over a long period of time. In contrast, we might expect the acquisition of tone in rule-governed domains to be acquired more easily, and perhaps earlier. We turn now to a discussion of these tonal rules.

Lexical tone rules
Subject markers. The tone of subject markers (SMs) is determined by the person and by the tense/aspect/mood of the construction. In the present affirmative, 1st and 2nd person SMs take Ø tone, and 3rd person is marked for H. This is shown in Figure 4.

```
H toned SMs    Ø toned SMs
  o-batla ...              ke-batla ...       Underlying representation


o-batla ...               ke-batla ...
  |                                           Lexical tone assignment
  H


o-batla ...               ke-batla ...
  | /                                         High tone doubling (HTD)
  H


o-batla ...               ke-batla ...
  | /   |                 |   |   |           Default low insertion
```

```
      H    L              L  L  L
ó-bátla ...              ke-batla ...
'S/he wants X'  'I want X'
```

Figure 4. Rule assigned tone on subject markers

It is possible that the acquisition of tone on subject markers would parallel that found for verb roots. On the other hand, subject markers represent a closed class, and the application of tone is rule governed. Furthermore, the inherent tone of subject markers is generally identical to that realized on the surface. Therefore, we might predict that children would acquire the correct tone for subject markers earlier and more easily than that on verb roots. But what about the acquisition of tone sandhi rules? We turn now to a discussion of High Tone Doubling.

High tone doubling (HTD) on verb roots. Sesotho has a rule of High Tone Doubling (HTD), where a H tone associated with the first syllable of a H toned verb root will double, or spread to the next syllable. This process is illustrated in Figure 5.

```
ke-rekela ...
                     Underlying representation
      H

ke-rekela ...
     |                Lexical tone association
     H

ke-rekela ...
     | /           High tone doubling (HTD)
     H

ke-rekela ...
  |   | / |          Default low insertion
  L  H  L

ke-rékéla ...
'I'm buying X for Y'
```

Figure 5. High tone doubling (HTD) on verb roots

The rule of High Tone Doubling (i.e. spreading of a H tone only to the adjacent syllable) is distinct from the rule of Iterative High Tone Spread (i.e. spreading of a H tone to the end of the word) - a rule that applies in the Tonal Melody that includes the perfective (e.g. *ke rékílé . . .* 'I bought X'). One of the acquisition problems would be to determine that these are two rules that apply in different contexts. We might expect that children would

initially collapse these two rules into one, being unaware of the different tense/aspect/mood domains to which they apply.

High tone doubling (HTD) from subject markers. Inherent in the theory of Lexical Phonology is the possibility for cyclic application of rules: After applying to a particular domain, a certain phonological rule can apply again to a different or larger domain. We have just discussed the application of HTD to the domain of the verb root. Once the subject marker and tense/aspect marker have been added to the verb root, the rule of HTD has another chance to apply. In this case the H tone on the subject marker spreads to only the following syllable, either the tense/aspect marker (T/A), if one is present, or onto the verb root itself (V). This is shown in Figure 6.

HTD to verb HTD to tense/aspect

o-lema...	o-a-lema	
		Underlying representation
o-lema ...	o-a-lema	
|	|	**Tone assignment**
H	H	
o-lema ...	o-a-lema	
| /	| /	**High tone doubling (HTD)**
H	H	
o-lema ...	o-a-lema	
| / | | / | |	**Default low insertion**
H L	H L L	
ó-léma ...	ó-á-lema	
'S/he's plowing X'	'S/he's plowing'	

Figure 6. High tone doubling (HTD) from subject markers

The acquisition of HTD from subject markers is of particular interest as it holds the key to understanding children's development of underlying tonal representations on verbs. Specifically, spreading of the H tone from the subject marker onto the verb root should *only* take place if the verb root is toneless (i.e. has Ø tone); if the verb root is L, spreading should not apply (i.e. the first syllable of the verb will already bear a tone). We turn now to a consideration of another class of tonal rules, those that are generally characterized as Obligatory Contour (OCP) Effects.

The obligatory contour principle (OCP)

In the phonology of many languages, identical phonological entities such as vowels, tones, and prominently stressed syllables, are prohibited from occurring next to each other.

Languages deal with this problem in different ways, in some cases 'fusing' two like elements to yield only one, in other cases modifying one such that two like elements are no longer adjacent. With regard to tone, the restriction is often one that prohibits two H tones from being adjacent on the tonal tier. Sesotho employs two rules of High Tone Delinking (HT Delinking) to avoid having a HH representation on the tonal tier. HT Delinking from subject markers reverses the effect of the rule of High Tone Doubling, i.e. the subject marker retains its H tone, but the tense/aspect marker looses the H it gained through Doubling. The tense/aspect marker is left unspecified for tone, and the sequence surfaces as HLH. This is illustrated in Figure 7.[2]

```
ba-a-bona
                    Underlying representation
        H

ba-a-bona
 |     |            Lexical tone association (verb root)
 H     H            Tone assignment (subject marker)

ba-a-bona
 | /   | /          High tone doubling (verb root)
  H     H           High tone doubling (subject marker)

ba-a-bona
 | /   | /          High tone delinking (OCP effect)
  H     H

ba-a-bona
 |  |  | /          Default low insertion
 H  L  H

ba-a-bona
 |  |  | /\         Phrasal lowering
 H  L  H  L%

bá-a-bóna+
'They see/understand'
```

Figure 7. High tone delinking from subject markers (OCP effect)

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[2] Note that this allows HTD to apply, and then undoes its effect with the use of a Delinking rule. This is, in effect, a 'repair' strategy, a solution some phonologists would prefer to avoid by simply not letting the rule apply in the first place (i.e. adopting a Blocking rule instead). However, as will be seen below, Sesotho still needs a Delinking rule to account for other OCP effects. Furthermore, the acquisition evidence indicates that the child may be applying HTD before OCP effects are acquired. Thus, it would appear that the acquisition scenario is indeed one of 'apply and repair', rather than 'block'.

HT Delinking on the verb root applies in a somewhat different domain: When a H toned verb root is adjacent to a H toned subject marker, it is the underlying tone on the *verb root* that gets delinked, again producing a HLH surface pattern. This is shown in Figure 8.

```
ba-bona ...
                       Underlying representation
      H

ba-bona ...
  |   |                Lexical tone association (verb root)
  H  H                 Tone assignment (subject marker)

ba-bona ...
  |   |/               High tone doubling (verb)
  H  H

ba-bona ...
  |   |/               High tone delinking (OCP effect)
  H   H

ba-bona ...
  |   |  |             Default low insertion
  H   L H

bá-boná ...
'They see X'
```

Figure 8. High tone delinking on verb roots (OCP effect)

In illustrating the workings of the Sesotho tonal system we have shown that there is not necessarily a one-to-one correspondence between underlying tone and its surface realization. This raises many questions about how such complex grammatical tone systems are learned. For example, how do children determine underlying tonal representations? Does the learning of underlying representations depend on learning some of the tone sandhi rules of the language? Is this process only mastered by the age of five, as suggested by Li & Thompson (1977) in the case of Mandarin, or are aspects of it acquired earlier? Are there any special 'learning strategies' that children employ in learning such a system? The following case study examines each of these questions.

THE CASE STUDY

The subject

The data for this study come from a monolingual Sesotho-speaking boy named Hlobohang, the only child of a rural mountain family in Lesotho. A five-year-old male cousin, mother and grandmother were living in the household during the twelve-month course of the study.

A profile of Hlobohang's and other Sesotho-speaking children's morphological and syntactic development are reviewed in Demuth (forthcoming).

The procedure

Audio recordings were conducted during spontaneous, naturalistic interactions between Hlobohang and his older cousin, mother, grandmother, and peers. Hlobohang was taped for 3-4 hours at five-week intervals over a period of twelve months. The data consulted for this study include sessions when Hlobohang was aged 2;1, 2;6 and 3;0 years. The data were drawn from the utterances that included a full verb phrase. The total number of utterances consulted for each session was 243, 496 and 582, respectively. Though the actual number of utterances per session increased over time, the number of utterances employing only simple present and future actually decreased, other tenses and H toned object markers being used in an increasing number of Hlobohang's utterances.

Audio recordings were made with a Superscope directional microphone and a Superscope/Marantz cassette recorder. The child's utterances, which had been transcribed in broad phonemic transcription, were retranscribed for tone by a non-Sesotho speaker and verified by the author at 90% accuracy. Any questionable utterances, where tone was not clearly audible, or where the disagreement between the two transcribers could not be resolved, were not included in the study. Transcription conventions include the marking of High tone (´), falling tone (^), mid tone (+), downstep (fl) and upstep (§), with Low tone left unmarked. Upstep is not part of the Sesotho phonemic inventory, however Hlobohang sometimes reset the tonal register, often for emphasis (cf. examples (12 & 13)). Although the number of examples that unambiguously address a particular tonal phenomena varies between the sessions sampled, they nevertheless exhibit significant developmental trends.

The present study is restricted to a consideration of grammatical constructions that fall into the Assertive Tone Melody - i.e. constructions in the present and future affirmative tenses, without object makers. The decision to focus on these particular constructions was two fold: First, these constructions are abundant at children's early stages of acquisition, though they had begun to decrease around 3;0 years as Hlobohang began to use an increasing diversity of tense/aspect forms and many more object markers. Secondly, these constructions provide ample evidence for the acquisition of underlying tonal representations, the application of tone sandhi rules in various domains, as well as the appropriate contexts for the application of Obligatory Contour Principle (OCP) effects and Tier Conflation problems. In all cases, examples that fully illustrate a particular phenomena can only be drawn from the subset of utterances that uniquely exemplify the acquisition of that phenomena. Specifically, constructions that introduce High tones (such as H toned subject markers or object markers) had to be carefully controlled for when investigating,

say, the underlying tone of verb roots. This study therefore attempts to provide a methodological framework that may be useful in the study of how other tonal systems are acquired.

We turn now to the discussion of Hlobohang's acquisition of the Sesotho tonal system, beginning with an examination of lexical tone assignment to verb roots, and then moving on to a discussion of how tonal rules are acquired.

Underlying level

Lexical tone assignment to verb roots. If we examine the acquisition of H and Ø toned verb roots between 2;1 and 3;0 years, we find some interesting developmental trends that are suggestive of strategies that Hlobohang may be using. The number of tokens and the percentage 'correctly' marked verb roots surfacing with either H or L tone respectively, are presented in Table 1. The data were drawn from examples with Ø toned subject markers (H toned subject markers would influence the tone on the verb stem). Although the total number of verbal utterances at 3;0 years was greater than that of the previous sessions, the number of present tense tokens available was much less due to the child's increased use of other tense forms (e.g. the *tlô* future), as well as the increased use of H toned object markers and 3rd person subject markers.

Age	H toned roots		Ø toned roots		Total No.of utterances
	N/total	*%*	*N/total*	*%*	
2;1	24/31	77	6/17	35	243
2;6	32/38	84	15/32	47	496
3;0	12/16	75	13/14	93	582

Table 1. Appropriate marking of lexical tone on verb roots

H toned verb roots were produced with H tone at least 75% of the time across all three ages sampled. In contrast, Ø toned verb roots were not as consistently produced with L tone: Only 35% of Ø toned verb roots at 2;1 years surfaced with L tone, the remainder surfacing with H tone on the first syllable. There was, however, a significant developmental trend toward appropriate marking of Ø tone verb roots, with 47% correct by 2;6 years and 93% correct at 3;0 years ($\chi^2 = 11.56$, $p \leq 0.01$).

Typical examples of early H toned verb roots are given in (3) and (4). The critical syllables are those in bold. When the Hlobohang's utterances differ segmentally or tonally from the appropriate adult equivalent, the latter is included below his utterance in parentheses. Morpheme breaks are provided in the child's utterance when possible.

(3) 2;1 yrs.   te-a-**há**na

(ke-a-**há**na+)

1sSM-PRES-refuse

'I refuse'

(4) 3;0 yrs.   o-**ngó**lá lengólo?

2sSM-write 5letter

'Are you writing a letter?'

Typical examples of Ø toned verb roots are given in (5) and (6), where the asterisk (*) indicates a *tonally* incorrect form.

(5) 2;1 yrs.   *a-**kú**la

(o-a-**ku**la)

2sSM-PRES-sick

'You are sick'

(6) 3;0 yrs.   ke-**ko**pa motohó

1sSM-ask 3porridge

'I'm asking for porridge'

Interestingly, some verb roots sometimes surfaced as H in one utterance, but as L in the next. This would appear to be in keeping with fluctuations that are typical of phonological development in general (e.g. Macken & Ferguson 1983), and consistent with morphophonological inconsistencies reported elsewhere in the early stages of Sesotho acquisition (Demuth 1988, 1992, forthcoming). One quite striking example, however, was of the very common H toned verb root *ho-hána* 'to refuse' - one of the earliest to be produced consistently with appropriate H tone (cf. (3) above). It surfaced incorrectly at 3;0 years with a L tone instead of a H tone on the first syllable (7).

(7) 3;0 yrs.   *ke-**ha**ná . . .

(ke-**há**ná . . .)

1sSM-refuse

'I refuse (to . . .)'

Thus, although there is a significant improvement by 3;0 years in the appropriate marking of tone on verb roots, there are still inconsistencies, especially with H toned verbs.

One might wonder why such inconsistencies exists, and what it says about Hlobohang's underlying tonal representations on verb roots. It is possible that some of these later fluctuations might indicate that the verb has not yet been 'assigned' to a particular verbal tone class. As we shall see in the following sections, however, certain other tonal 'errors' are found around 3;0 years, also involving H tones being produced as L.

In sum, we find the majority of H toned verb roots produced as H at all ages sampled, and there is a developmental trend toward the appropriate marking of Ø toned verb roots by 3;0 years. This means that, at 2;1 years, the majority of both H and Ø toned verb roots are produced as H, almost as though Hlobohang were using some sort of a Default High Strategy in the marking of verb roots at this time. Note, however, that 35% of Ø toned verbs surface with L tone at this time, indicating that verbs have already been divided into two tonal groups. What, then, do the child's underlying tonal representations actually look like? Does he know, at 2;1 years, that it is not necessary to mark L tone underlyingly? The two possible underlying representations that he might have at 2;1 years can be schematized as in Figure 9, where a H/L representation is referred to as Full Specification, and a H/Ø representation is referred to as Selective Underspecification (v = verb root, as listed in the lexicon).

A. Full specification   *B. Selective underspecification*

```
     H  L                              H  Ø
     |  |                              |  |
    [v  v]                            [v   v]
```
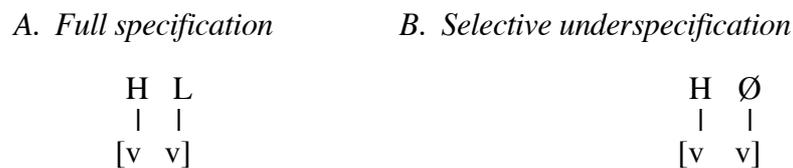
Figure 9. Possible underlying representations (URs)

The Underlying Representations (URs) provided in A. represent a system like that found in languages like Kikuyu (Clements & Ford, 1981), where both H and L tone are marked underlyingly. This contrasts with the URs provided in B., characteristic of languages like Sesotho where only H tone need be specified. It is unclear, from the examination of tone on verb roots, which of these URs Hlobohang might have at 2;1 years, or even at 3;0 years. An examination of tone sandhi effects, especially those involving High Tone Doubling, should provide the necessary evidence for determining which of these URs Hlobohang is positing at different stages of development.

In this section we have examined Hlobohang's marking of tone on verb roots. We have found that the accurate marking of lexical tone on Sesotho verb roots does not occur immediately, as it does in lexical tone languages like Mandarin Chinese, but gradually, with improved accuracy over time. Indeed, it appears that his early working strategy is to mark verb roots as H until sufficient exposure to the language provides evidence that some

should be marked as L or Ø. In other words, Hlobohang appears to be using a Default High Strategy in the marking of lexical tone. Other parts of Sesotho grammar, in particular closed class items such as subject markers, are assigned tone by rule. We turn now to an examination of the acquisition of tone on subject markers, and to an investigation of how lexical tone rules in general are acquired.

Lexical tone rules

Subject markers. We have shown above that Hlobohang appears to be using a Default High Strategy as an initial approach to positing underlying tone on verb roots. We might therefore predict either that 1) the acquisition of subject markers will parallel that of verb roots (i.e. subject markers will surface predominantly as H), or that 2) there will be an early and consistently appropriate distinction between H and Ø toned subject markers. With the notable exception of H toned subject markers at 3;0 years, the findings presented in Table 2 argue for the latter. The data were drawn from subject markers found with verb roots that surfaced with both H and L tone (this included verbs that were both H or Ø in the adult system).

Age	H toned SMs		Ø toned SMs		Total No.of utterances
	N/total	*%*	*N/total*	*%*	
2;1	13/17	77	48/58	83	243
2;6	12/15	80	65/78	83	496
3;0	19/33	58	29/34	85	582

Table 2. Appropriate marking of tone on subject markers

Table 2 shows around 80% accuracy in the appropriate marking of both H and Ø toned subject markers at 2;1 years. In other words, there appears to be no Default High Strategy used in the marking of SMs. Typical examples are given in (8) and (9).

(8) 2;1 yrs. **é-**a kae?
(**ó-**ya kae?)
1SM-go where
'Where is s/he going?'

(9) 2;1 yrs. **a**-echá hápe

(**ke**-etsa hápe)[3]

1sSM-do again

'I'm doing (it) again'

As might be expected, a large portion (43=74%) of the Ø toned subject markers at 2;1 years are the 1st person singular subject marker *ke* 'I'. Note furthermore that tone on the subject markers in (8) and (9) is marked appropriately prior to the wellformedness of the segments in these morphemes.

Table 2 shows that Ø toned subject markers surface as L consistently across time, with an accuracy rate of over 80%. This differs, however, from the marking of H toned subject markers, where there is a regression in the appropriate marking of tone at 3;0 years. Why should this be the case? Compare the appropriate surfacing of L tone in (10) with the inappropriate realization of H tone on the subject markers in (11a-b).

(10) 3;0 yrs. roná **re**-ngola ká-ng?

(roná **re**-ngólá ká-ng?)

1pPN 1pSM-write PREP-what

'As for us, what are we going to write with?'

(11a) 3;0 yrs. ***a**-chécha

(**é-á**-checha)

9SM-PRES-reverse

'It's reversing'

(11b) 3;0 yrs. ***e**-á-fihla ká tlu-ng

(**é**-yá-fihla ká tlu-ng)

9SM-FUT-arrive PREP 9house-LOC

'It will get into the house'

In (11a) the subject marker and tense marker have been collapsed into one syllable; even so we would expect a H tone to be preserved, but it is not. Interestingly, in (11b), where both subject marker and tense marker are present, a H tone surfaces on the tense marker only.

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[3] *Ho-etsa* 'to do/make' is not normally an object drop verb, however children sometimes use it in this way, and this is how it has been analyzed in the present example. The adult equivalent would include an object marker '*e*' that contributes a H tone to the first syllable of the verb: *ke-e-étsa hápe* 'I'm doing it again'.

We will see in the following sections that tone sandhi rules involving OCP effects are in the process of being acquired around 3:0 years, and that the regression in performance on H toned subject markers is a result of the inappropriate mapping of those tonal melodies onto segments.

In this section we have seen that Hlobohang shows a critical difference in the developmental marking of tone on subject markers and verb roots. In particular, early stages of acquisition show a Default High Strategy applied to the marking of tone on verb roots, but subject markers are relatively accurately marked at 2;1 years. Why should there be a difference in the appropriate marking of tone on these two forms? There are several possible explanations. First, the difference in acquisition patterns might be due to the *level* at which tone is assigned - i.e. verb roots are assigned tone underlyingly, and subject markers are assigned tone at the lexical level. From a 'top-down' surface-to-underlying representation perspective one might suppose that tonal processes taking place closer to the surface would be more accessible, and that those that are 'deeper' would take longer to be acquired. However, a quick glance at Mandarin Chinese, where underlying lexical tone is acquired early, and tone sandhi effects are acquired later, shows that a level ordering approach does not account for the Mandarin-Sesotho differences.

Alternatively, the difference in the acquisition of tone on Sesotho verb roots and subject markers might be due to a difference in 'recoverability' - i.e. subject markers generally retain their tone at the surface, but the underlying tone of verb roots frequently differs from its surface form. In other words, the tone that surfaces on verb roots is often influenced by tone sandhi rules, but the tone that surfaces on subject markers is not.

Although the problem of recoverability is obviously an important one, and no doubt facilitates the early acquisition of lexical tone in languages like Mandarin (where there is limited tone sandhi), we suggest that the difference in Hlobohang's acquisition of Sesotho subject markers and verb roots lies elsewhere. Crucially, Sesotho subject markers do not constitute 'lexical items' in the same sense that verb roots do. Rather, they are 'bound clitics' and are assigned tone predictably by grammatical rule in the word formation part of the grammar. In contrast, the tone of verb roots is idiosyncratic, having to be learned verb by verb, and having to be marked as such in the lexicon. Furthermore, subject clitics constitute a closed class, while verb roots are drawn from an open class with a potentially unrestricted set of members. Once a rule is learned, it can be applied across the board. In contrast, the learning of underlyingly assigned tone proceeds slowly on an item-by-item basis, hampered in the Sesotho case by problems of recoverability.

In sum, subject markers are clitics assigned tone by rule, but verb roots must be assigned tone as part of an abstract underlying lexical representation. The latter takes even longer to learn when there is a large amount of 'noise', or tone sandhi. Recall that

Hlobohang appears to employ a Default High Strategy in the acquisition of tone on verb roots. Hlobohang's acquisition of various tone sandhi rules provides further clues as to the form of his early underlying representations. We turn now to a discussion of these tonal rules and how they are acquired.

High tone doubling (HTD) on verb roots. The critical examples that provide evidence for the acquisition of HTD are H toned verb roots of four syllables, or H toned verb roots of three syllables that are non-final in the verb phrase. Few verb roots from the Hlobohang's corpus fit this criteria; the majority of verb roots, especially in the earlier samples, are di- or trisyllabic phrase-final forms. Of the former that are H toned, only one example did not show apparent HTD when in non-final position in the verb phrase. Note, however, that those that *do* show apparent HTD are also consistent with an Iterative Spreading analysis. Thus, they cannot be used as evidence to show that Hlobohang has actually acquired the rule of HTD.

Of the verb roots that qualify, only a few show unambiguous HTD (12); others show Iterative Spreading (13).

    (12) 2;6 yrs. séfofánu syá-§**bídíka** kwána
                     (sefófáne sé-a-**bídíka** kwána)
                     7airplane 7SM-PRES-turn LOC
                     'The airplane is turning about over there'

    (13) 2;6 yrs. *wená á-**máthélá** §má::::ne Chabadímachetse kwana
                     (wená o-**mathela** mâ:né Chabadímaketse kwána)
                     2sPN 2sSM-run to LOC Ch. LOC
                     'You're running WA:Y over there at Chabadimaketse,
                                                 far away'

However, by 3;0 years most H toned verb roots show appropriate application of HTD, as seen in (14) and (15).

    (14) 3;0 yrs. tsa-**sébétsa** mo
                     (ke-a-**sébétsa** móna)
                     1sSM-PRES-work LOC
                     'I'm working here'

(15) 3;0 yrs.   te-bi **b(í)néla** (A)si Mamélo

(ke-**bínéla** Aúsi Mamélo)

1sSM-sing for sister Mamelo

'I'm singing for Sister Mamelo'

Note that in (15) Hlobohang self-corrects, the verb root initially starting out with L tone, but subsequently surfacing with H tone (the parentheses around his vowels indicate partial devoicing).

If HTD is being applied to verb roots at 3;0 years, we might expect to find it applying with subject markers as well. We turn now to a consideration of HTD from subject markers.

High tone doubling (HTD) from subject markers. The context for unambiguous application of HTD is where H toned subject markers are used with Ø toned verb roots. Although the number of examples is few at 2;1 years, there does not appear to be early application of HTD, as shown by the lack of Doubling onto the verb root in (16).

(16) 2;1 yrs.   ***á-e**ta móda

(**á-é**tsa móna)

6SM-do LOC

'They're doing (it) here'

It is frequently the case that the subject marker and tense/aspect marker have been collapsed into one syllable, thus obscuring the segmental context for the application of HTD. We might expect, however, that coalescence might precede the assignment of tone, and that the H tone would spread to the first syllable of the verb stem. However, as seen in (17), there is no overt evidence that HTD has applied.

(17) 2;6 yrs.   ****á**-nyola kho꞉fú yéna*

(*é-**á**-nyoloha khofú éna*)

9SM-PRES-ascend 9dumptruck 9DEM

'It's ascending, this dumptruck'

Indeed, there are even cases where both the subject marker and tense marker are realized, but where the H tone has not spread to the tense marker (18).

(18) 2;6 yrs. ***é-a-**tsamaya koloi yaka
(**é-á**-tsamaya koloi yáka)
9SM-PRES-leave 9car 9POSS-my
'It's leaving, my car'

Other cases show possible iterative H tone spread rather than Doubling, though (19) could also be a case where the Ø toned verb root is being incorrectly treated as H.

(19) 2;6 yrs. ***á-**wélá nth(ò) éná...
(**é-á**-wela ntho éna...)
9SM-PRES-fall 9thing 9DEM
'It's falling, this thing...'

By 3;0 years, however, HTD from subject markers seems to have been acquired, as shown by the appropriate application of Doubling to both the verb root (20) and to the tense/aspect marker (21).

(20) 3;0 yrs. **é-tsá**ma ká tsê:lâ:
(**é-tsá**maya ká tsela)
9SM-leave PREP 9road
'It's leaving by the road'

(21) 3;0 yrs. dikólóy tse di . . . di . . . **dí-á**-tsamay(a)
(dikolói tséna **dí-á**-tsamaya)
10car 10DEM 10SM-PRES-leave
'These cars are leaving'

Note the parallel between examples (18) and (21), where similar sentences are uttered 6 months apart, the second time with the appropriate HTD pattern. Note also that the same verb (*ho-tsamaya* 'to leave') appears in both (20) and (21), the first with HTD onto the first syllable of the verb root, the second with HTD applying on the present tense marker. In other words, Hlobohang appears to be able to control the rule of HTD, regardless of the morphological domain. It would appear that, by the age of 3, he has acquired knowledge about how and where to apply HTD.

In this section we showed that the rule of High Tone Doubling (HTD) applies to both verb roots and subject markers. Although there is no evidence that Hlobohang knows of, or knows how to apply HTD at 2;1 or 2;6 years, by 3;0 years he appears to be able to

control its use and apply it to the appropriate morphological domains. This is evidenced both by examples showing the appropriate application of Doubling (as oppose to Iterative Spreading), as well as the cyclic application of HTD from both verb roots and subject markers.

The three contexts where HTD appears are summarized in Table 3.

	Context for HTD application	*Surface form*	*URs*
I.	On verb roots	ke-**réké**la ...	
II.	From SM to T/A marker	**ó-á**-lema	
III.	From SM to verb root a.	**ó-lé**ma ...	H/Ø
		b. **ó-le**ma ...	H/L

Table 3. High tone doubling (HTD) and underlying representations (URs)

Case III. provides the critical evidence for determining Hlobohang's underlying representations. The surface forms given in IIIa. can only occur if underlying representations are H/Ø. Surface forms like that in IIIb. will result if underlying representations are H/L. Once there is evidence of having acquired the rule of HTD, there is also evidence from forms like that in (20) that Hlobohang's underlying representations are H/Ø. Recall that by three years Hlobohang is doing much better at producing underlyingly Ø toned verbs with L tone. It would appear that the acquisition of lexical tone goes hand-in-hand with the learning of HTD.

In Sesotho, OCP effects have the potential for reversing the effect of HTD, with further implications for our understanding of Hlobohang's underlying representations. We turn now to an examination of how OCP effects are acquired.

The Obligatory contour principle (OCP) and tier conflation problems
Recall that OCP effects in Sesotho are manifest by two Delinking rules. Due to the problem of subject markers and tense/aspect markers being frequently coalesced in early child speech, it is difficult to determine if the rule of HT Delinking has been acquired even by 3;0 years. However, on those examples where a clear segmental distinction is made, there is no evidence that Delinking from subject markers has been acquired (22-24), even with very commonly and correctly used H tone verb roots like *ho-hána* 'to refuse' (23 & 24).

(22) 3;0 yrs. *ebílé kodoi yáká **é-á-tjé**na+   [HHH]

(ébilé kolói yá-ká **e-a-ké**na+)   [HLH]

CONJ 9car 9POSS-my 9SM-PRES-enter

'In fact, my car is going in'

(23) 3;0 yrs. ***e-á-há**na+   [LHH]

(**é-a-há**na+)   [HLH]

9SM-PRES-refuse

'It refuses'

(24) 3;0 yrs. ***wa**-**há**na   [LH]

(**ó-a-há**na+)   [HLH]

1SM-PRES-refuse

'He refuses'

We see that no Delinking has applied in (22), with a HHH surface pattern resulting. In contrast, examples like (23), with a LHH surface pattern, indicate that some Delinking may have taken place, but that the application of the rule has involved the wrong syllable. Critically, the H on the *tense* marker should be delinked, not the H on the subject marker.

In (24) we see that the subject marker and tense/aspect marker have coalesced, leaving only two TBU's to receive a three syllable HLH melody. In similar situations many Bantu languages preserve tone, creating a contour tone (e.g. falling, rising). However, Hlobohang appears to map the HLH melody onto the available segments in a one-to-one mapping, thereby omitting the initial H tone. The result is that only the LH part of the tonal melody gets mapped onto segments, the initial H tone having no place to 'dock'. Here we see evidence that Hlobohang knows about the Delinking rule, but that, due to subsequent coalescence, the initial H tone is not realized at the surface. It would appear, then, that the child has the correct tonal representation on a separate tonal 'tier', but that the incorrect surface form results from a problem of mapping tones onto the available segments. We call this tonal mapping problem the Tier Conflation Problem.

Examples such as (23) and (24) are interesting for at least two reasons: First, recall from Table 2 that there was a 'regression' in the appropriate marking of H toned subject markers from 80% correct at 2;6 years to 58% correct at 3;0 years. We suggested this might be due to the overgeneralization of a tone sandhi rule. Examples such as (23) and (24) indicate that OCP effects are being learned at 3;0 years, but that the domain to which they apply has not yet been fully acquired, the L frequently falling on the subject marker, even in cases where coalescence has not taken place.

Secondly, examples like those in (23) are interesting from the perspective of linguistic theory. As noted above, the choice of positing a Delinking rule, rather than a Blocking rule to account for the resulting L tone on tense markers is, to a certain degree, a theory internal matter: Some phonologist would prefer to use Blocking rules rather than apply rules and then reverse their effect. However, in examples like (23), where the tense/aspect marker surfaces with H tone, High Tone Doubling has already taken place. HT Delinking then applies, but the mapping of the HLH melody onto segments is not appropriately realized. Thus, the acquisition evidence supports the adoption of a Delinking rule rather than a Blocking rule. We suggest that the acquisition of other phonological phenomena may likewise provide evidence for choosing between different theoretical treatments of linguistic problems.

Further support for the use of a Delinking, rather than a Blocking rule, comes from the fact that a rule of Delinking is needed in another domain. Although there is some evidence of Delinking on verb roots at 2;6 years (25), the majority of examples are more like that shown in (26), where no Delinking takes place.

(25) 2;6 yrs. **bá-kuká** mollo   [HLH]
                   2SM-pick up 3fire
                   'They're taking the flame'

(26) 2;6 yrs. *kolóy yá-ká **é-thóthá** mokúlú: [HHH]
                   (kolói yá-ká **é-thothá** mokúlúbe)   [HLH]
                   9car 9POSS-my 9SM-carry 3horse dung
                   'My car is carrying horse dung'

Interestingly, there is another set of examples that indicate that Hlobohang *does* have some sort of HT Delinking rule on verb roots around 2;6 years. We have noted that underlyingly H toned verb roots (with Ø toned subject markers) are generally produced as H at 2;6 years. There is, however, an interesting set of four examples where H toned verb roots surface with L tone on at least the first syllable. These are cases where the subject marker is (ungrammatically) omitted, and where the stressed pronoun *nná* 'me' is used. The first syllable on the verb root surfaces as L, producing a HLH pattern (27).

(27) 2;6 yrs. ***ná bidí**kísa   [H   LH]
                   (**nná ke-a-bídí**kisa)   [HLLHH]
                   1sPN 1sSM-PRES-turn
                   'Me, I'm revolving (it)'

Through the omission of several syllables, two H tones becomes adjacent on the tonal tier, and Hlobohang has delinked the second of these. Thus, although the domain of application is not quite appropriate, such examples may be early attempts at producing the rule of High Tone Delinking. What is particularly interesting about examples like (27) is that they provide evidence for the independence of tonal and segmental tiers even at 2;6 years.

By 3;0 years Delinking on verb roots more frequently applies in obligatory contexts (28), but continues to be overgeneralized to inappropriate contexts like that in (29).

(28) 3;0 yrs.   le-§léng **dé-dulá** k(áe)?   [HLH]

                 (lé-léng **lé-dulá** káe?)   [HLH]

                 5-other 5SM-live where

                 'Where does the other one live?'

(29) 3;0 yrs.   *ébiléng **o-tlá-shap-ú**wa Molólo   [LHLH]

                 (ébiléng **o-tla-sháp-ú**wa Molólo)   [LLHH]

                 CONJ 2sSM-FUT-PASS Mololo

                 'As a matter of fact, you will be lashed, Mololo'

We have already seen above that overgeneralization of the OCP applied in the case of the subject marker. Here we see that overgeneralization of Delinking on verb roots provides further evidence that Hlobohang has some notion that a HLH pattern is required, but that control of the domain to which it applies has yet to be fully acquired. In other words, Tier Conflation continues to pose a problem at 3;0 years, even when all the segments are present.

We should state here that Delinking on verb roots appears to be a variable rule - present in some dialects and not in others (Demuth, 1991; Kisseberth, 1989). What is particularly interesting about this rule is that it appears to be idiolectal: of young speakers growing up in the same community in Lesotho, some have the rule of Delinking, and others do not. In other words, examples like (26) would be 'correct' in some speakers' grammars. Although Hlobohang's parents and grandparents *did* use the rule, Hlobohang is presumably exposed to variable input, perhaps accounting, in part, for the some of the observed overgeneralization. Note, however, that Delinking from the subject marker is an obligatory rule in all speakers' grammars, and that it is also overgeneralized. Thus, variable input cannot be the primary explanation behind the variable application of Delinking in Hlobohang's grammar.

In this section we saw that OCP effects are in the process of being acquired at 2;6 years, but that overgeneralization of Delinking rules to inappropriate segmental domains persists at 3;0 years. It is therefore evident that Hlobohang realizes a HLH melody is involved, but does not yet control the domain to which it applies. This illustrates the independence of tonal and segmental tiers, and the fact that tonal mapping, or more generally, Tier Conflation, is not a straightforward process. Finally, we found that Hlobohang acquires HTD first, with Delinking, or application of OCP effects applying to the output of HTD. This points to the existence of ordered rule application in Hlobohang's grammar, rather than the use of a Blocking rule that prohibits HTD from applying in the first place.

DISCUSSION

This study has examined one child's acquisition of underlying tonal representations and lexical tone rules in Sesotho. First, it found an early Default High Strategy in the marking of verb roots, with the appropriate marking of underlying lexical tone occurring gradually over time. This contrasted with the early acquisition of tone on subject markers. Secondly, the rule of High Tone Doubling (HTD), along with the appropriate postulation of H/Ø underlying representations, appear to be acquired by 3;0 years. Finally, Obligatory Contour Principle (OCP) effects are beginning to be acquired between 2;6-3;0 years, but the accurate application of these rules is delayed due to Tier Conflation problems.

These findings are interesting on two accounts: First, they provide insight not only into the acquisition of tonal systems, but into the acquisition of phonology in general. They are of particular interest for understanding how children arrive at underlying representations, as well as for how phonological rules, including OCP effects, are acquired. Secondly, they are useful for informing phonological theory, both as it relates to the ordering of rule application, as well as for addressing the status of the OCP as either a rule or a principle of Universal Grammar. We discuss these issues briefly below.

Most of the work on the acquisition of tone has examined lexical tone languages like Mandarin Chinese. It is generally found that the acquisition of lexical tone in such languages takes place along with the acquisition of the lexical item itself, tone often being correctly realized prior to the wellformedness of the corresponding segments. Thus, speakers of lexical tone languages like Mandarin generally have access to the correct underlying tonal representations of words by the age of 2. This contrasts with the Sesotho findings, where the underlying tone of verb roots appears to be acquired gradually over time, on an item-by item basis. It would appear that the richness and pervasiveness of tone sandhi rules in grammatical tone languages like Sesotho produces recoverability problems, making the mapping problem between surface and underlying representations a more

difficult and prolonged undertaking. We might suspect that the positing of appropriate underlying representations would be worked out in conjunction with the acquisition of certain tone sandhi effects, and this appears to be the case: The significant improvement in the appropriate marking of Ø toned verb roots at 3;0 years coincides with evidence that 1) the rule of HTD has been acquired, 2) underlying representations are H/Ø, and 3) the application of OCP effects is under way. Thus, the acquisition of underlying representations in languages with rich tone sandhi appears to be acquired in conjunction with the acquisition of the rest of the tonal system. In contrast, the acquisition of rule assigned tone, such as that assigned to subject markers, appears to be much easier to acquire. This finding, in conjunction with the early Default High Strategy, provides motivation for the possibility that the earliest underlying tonal representations on verbs are uniformly H and assigned by rule (cf. Clements & Goldsmith, 1984).

Finally, the data in this study provide information concerning the form of linguistic rules and the status of the OCP. We noted in the discussion of OCP effects that Delinking effectively reverses the result of High Tone Doubling. The alternative would be to posit a Blocking rule that prohibited that application of HTD in the first place. However, the acquisition data show that HTD must have applied prior to the application of OCP effects. In other words, positing one rule of High Tone Blocking cannot account for the empirical findings. Secondly, this study raises the issue of the status of the OCP as either an organizing principle of Universal Grammar (e.g. McCarthy, 1986), or as merely a language specific rule that must be learned (e.g. Odden, 1986, 1988). Although it is not entirely clear what type of acquisition evidence would strongly support one or the other of these positions, this study shows that OCP effects are overgeneralized to inappropriate contexts as early as 2;6 years. Whether this overgeneralization is the result of the robust over application of a *rule*, or the organizing influence of a Principle of Universal Grammar is unclear. What is clear, however, is that overgeneralization of OCP effects begins prior to the acquisition of the rule of High Tone Doubling.

This paper presents a case study of how one child constructs underlying tonal representations in a complex grammatical tone system. In so doing, it provides a glimpse of the types of strategies children may use in organizing their phonological systems. In the process of examining how this takes place, the study raises many other questions which are yet to be fully addressed. It is hoped, however, that it provides the beginnings of a framework for stimulating further research in this area.

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