

Phonological Acquisition and Phonological Theory

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The Acquisition of Tonal Systems

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1. THE ACQUISITION OF TONE: AN OVERVIEW

Autosegmental approaches to phonology developed, in part, from attempts to capture the systematic yet apparently complex grammatical tone systems found in many African languages (Goldsmith, 1976; Leben, 1973; Williams, 1976). Since that time, the development of phonological theory has contributed greatly to the understanding of other nonlinear problems that had previously eluded traditional segmental analysis (cf. Goldsmith, 1990). The field of acquisition, however, has been slow to adopt and integrate new perspectives from theoretical phonology. Much work on the acquisition of phonology has utilized a segmental approach based primarily on insights from structural linguistics (Jakobson, 1941/1968) or Chomsky and Halle (1968), henceforth SPE (Smith, 1973). Even recent volumes on the acquisition of phonology (e.g., Ferguson, Menn, & Stoel-Gammon, 1992) have focused primarily on segmental issues. This is despite the fact that some early researchers realized the importance of a prosodic approach to acquisition issues (e.g., Kiparsky & Menn, 1977; Spencer, 1986; Waterson, 1971, 1987). In this chapter I pursue an autosegmental analysis of both lexical and grammatical tone, investigating the acquisition of tonal representations, tonal sandhi rules, and the mapping between tonal and segmental tiers in Sesotho, a southern Bantu language.

1.1. The Acquisition of Lexical Tone

In any study of tone a distinction must be drawn between the lexical or grammatical uses of pitch, which involve language-based form-meaning correspondences, and the early use of intonation for affective purposes. 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. In fact, it is reported that young children perceive prosodic contours and pitch excursions from infancy (Mehler et al., 1988). On the other hand, other prosodic aspects of English, such as stress assignment, are apparently not fully acquired until around 12 years (cf. Crystal, 1986).

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, at around 1;11 to 2;2 years (cf. Clumeck, 1980; Crystal, 1986). It is also suggested that even 1-year-olds can begin to discriminate lexical items that are tonal minimal pairs (Tse, 1978). Much of the research addressing the acquisition of tone took place before the full development of autosegmental phonology and therefore dealt mostly with issues of lexical tone. These studies include the examination of spontaneous speech in early Thai (Tuaycharoen, 1977), Mandarin (Chao, 1973; Clumeck, 1977; Li & Thompson, 1977), and Cantonese (Tse, 1978; cf. Clumeck, 1980, for an overview). These studies indicate that children generally control the production of lexical tone by the age of 2, prior to the full control of segments. Kirk (1973) also reported that naturally occurring imitations by 2- to 3-year-old Gã-speaking children of southern Ghana more accurately rendered tonal patterns than either rhythm or segments.¹ It would appear, then, that children learning such languages may be able to assign the correct underlying tonal representation to words from an early age.

1.2. The Acquisition of Tone Sandhi

In this chapter I am concerned not only with the acquisition of lexical tone, but also with the acquisition of tonal rules, or tone sandhi. From the few studies that address this issue, it appears that tone sandhi is more difficult to learn than lexical tone, (Demuth, 1989, 1991, 1993; Li & Thompson, 1977). For example, Li and Thompson (1977) noted that lexical tone in Mandarin was acquired early but reported that tone sandhi was acquired as late as 5 years. Studies of the acquisition of tone and tone sandhi in several Bantu languages, where tone plays a prominent grammatical as well as lexical role, support this finding. Some of the general patterns found are outlined here.

¹Gã, however, has some tone sandhi; a fuller study of the Gã tonal system and the aspects of it that children control is needed before further conclusions can be drawn.

Chimombo and Mtenje (1989) examined the acquisition of negation constructions and tone in three Chichewa-speaking children between the ages of 1 and 2;6. They found that tonal patterns were acquired before segments and morphemes were well formed, but that the tonal rules that apply to different negative constructions were not fully in place by 2;6 years. Moto (1988) provided a brief sketch of how both lexical and postlexical tonal phenomena are acquired in Chichewa, but this work has yet to be pursued.

Demuth (1989, 1991, 1993) reported that pervasive tone sandhi may actually impede the acquisition of lexical tone. Data from a longitudinal, in-depth study of one child between the ages of 2 and 3, plus findings from a cross-sectional study of 11 children between the ages of 2;11 and 5, indicated that younger children overgeneralize the use of High (H) tone on lexical verbs; yet they generally use tone correctly in the marking of person (first and second person = Low (L) tone, third person = H tone). Findings also involved H tone spreading, acquired by 3 years, and OCP effects, which are still being acquired at 3. These findings and their theoretical import are discussed in detail in this chapter.

Evidence from the acquisition of tone in Zulu is consistent with the picture that emerges from the aforementioned studies. Suzman (1991), in a naturalistic study of nine Zulu-speaking children between the ages of 2;6 and 4, reported that nouns were generally produced with correct tone, much as in the acquisition of lexical tone reported in Asian languages. Similarly, tone was generally used correctly in the marking of person. However, only slightly more than half of the verbal constructions included appropriate tone. Overgeneralization of H tone was especially prominent among 2-year-olds, whereas 4-year-olds showed increased accuracy at 60%–80%.

The acquisition of grammatical tone systems such as those found in most Bantu languages provides especially rich ground for studying how children learn complex phonological systems. Although the findings reported here focus on the acquisition of tone, they are also relevant for theoretical questions concerning acquisition in other prosodic and phonological domains, as well as for informing the construction of acquisition theory in general.

1.3. Theoretical Issues

Linguistic theory and acquisition theory are only beginning to influence our understanding of how phonology is acquired. However, there appear to be certain recurrent patterns emerging from studies of the acquisition of tonal systems, and any theory of phonological acquisition should be able to account for these phenomena. For example, the Bantu studies mentioned earlier reported the overgeneration of H tone on verb roots. How does the child determine how many underlying tones to posit for the language being learned? And given a specific set of tonal primitives, how does the child

determine which one should be employed as a default tone? Previous studies also reported the predominance of sequences of like tone in children's early productions. Perhaps children have a default setting of automatic H tone spread. Or perhaps the sequence of like surface tones is due to the strong application of the Obligatory Contour Principle (OCP), where underlying adjacent tones are fused.

Issues such as the role played by principles of Universal Grammar in guiding the acquisition of phonology have been largely unaddressed to date. What, for instance, are the principles (such as the OCP) that might guide the acquisition of tonal systems? Likewise, issues regarding parameter setting are only beginning to be discussed (e.g., Dresher & Kaye, 1990), and only with regard to specific domains (e.g., stress systems). Could the acquisition of different types of tonal systems be captured from a parametric perspective (e.g., tonal vs. pitch accent vs. stress accent systems), and could this provide insight into the acquisition of these systems? Obviously, further theoretical work, as well as empirical studies relating to these issues, is needed to address these questions more fully.

What does emerge from all the studies reported here is that the realization of at least some types of lexical tone is well formed and in place prior to the appropriate realization of segments. This means that some aspects of tonal systems are among the earliest parts of the phonological system to be acquired. Tonal systems therefore provide a unique opportunity for examining the very early organization of children's linguistic systems.

I turn now to underlying and lexical aspects of the Sesotho tonal system, and examine one child's acquisition of the system.

2. THE SESOTHO TONAL SYSTEM

There have been several early descriptive studies of the Sesotho tonal system (Köhler, 1956; Kunene, 1961, 1972; Letele, 1955; Tucker, 1929/1969; see also Doke & Mofokeng, 1957). In this chapter I restrict my discussion to auto-segmental treatments of the Sesotho tone, focusing on the verbal system (cf. Clements, 1988a; Khoali, 1991; Kisseberth & Mmusi, 1989; Mmusi, 1991).

Sesotho can be described as a grammatical tone language with a restricted tonal system, that is, a system where not every syllable, morpheme, or word must be encoded for tone in the lexicon. In other words, although it is necessary to posit High tone underlyingly, it is not necessary to posit Low tone underlyingly. This means that verb roots can be specified underlyingly as having either H or \emptyset 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. A 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 is illustrated in (1) and (2).²

- (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 realization and underlying tonal representations. For instance, if *ho-réka* 'to buy' were used with a third person subject marker, which is also H toned, the first syllable of the verb would lose 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 third 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. One of the acquisition problems 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, this chapter focuses on the present and future tense forms, and on the tonal phenomena that apply at underlying and lexical levels of the phonology.

After a brief discussion of lexical tone assignment to verb roots, I discuss rule-assigned tone on subject markers. I then illustrate the rule of High Tone Doubling (HTD) and the effects of the Obligatory Contour Principle (OCP).

3. THE DATA

Demuth (1992b) provided a general profile of Sesotho-speaking children's morphological and syntactic development. The data discussed in this chapter come from a monolingual Sesotho-speaking boy (H)—one of the children

²Glosses 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, *batbo* 'people' and other plural human nouns = noun class 2, *dijo* 'food' = noun class 8). 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.

discussed in that study. Audio recordings were made during spontaneous, naturalistic interactions between the child and his older cousin, mother, grandmother, and peers. Recordings consisted of 3 to 4 hours of interaction taped at 5-week intervals over a period of 12 months. The data consulted for this study were produced during sessions at 2;1, 2;6, and 3;0 years of age. The data were drawn from the utterances that included a full verb phrase. By this criterion, the three sessions yielded 243, 496, and 582 utterances, respectively.

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 (ˊ), falling tone (ˋ), mid tone (+), downstep (↓), and upstep (↑), with Low tone left unmarked. Upstep is not part of the Sesotho phonemic inventory; however, children sometimes reset the tonal register, often for emphasis (cf. examples (12) and (13)). Although the number of examples that unambiguously address a particular tonal phenomenon varies between the sessions sampled, the examples nevertheless exhibit significant developmental trends.

As noted earlier, this study examines present and future tense constructions, without object markers. The decision to focus on these particular forms was twofold: First, these constructions are abundant at children's early stages of acquisition, though they begin to decrease at around 3;0 years as children began to use an increasing diversity of tense/aspect forms and many more object markers. Second, these constructions provide ample evidence for the acquisition of underlying tonal representations and the application of tone sandhi rules in various domains, as well as the appropriate contexts for the occurrence of OCP effects and Tier Conflation problems.

I turn now to an examination of lexical tone assignment to verb roots and the acquisition of underlying tonal representations.

4. UNDERLYING LEVEL

4.1. Lexical Tone Assignment to Verb Roots³

Tone on Sesotho verb roots is assigned underlyingly in the lexicon (either H or Ø). If the verb is lexically marked for H tone, a H tone is then predictably associated with the first syllable of the verb root at the lexical level; if the

³Tone bearing units (TBUs) left unspecified for tone at the surface are filled in with a late postlexical rule of Default Low Insertion. Perpendicular lines (|) = initial tone associations, slant lines (/) = associations that arise through spreading. + indicates a mid tone (a lowered high tone) found at certain phrasal boundaries (cf. Khoali, 1991).