

Accentual Effects on Lateralization

Soojung Kim*

ABSTRACT

Lateralization, the change of a coronal nasal into a lateral in an *l-n* sequence, has been considered to be prosodically unrestricted, e.g. an utterance-span rule, in Korean (Han 1993, Park 1990). However, aerodynamic data of the nasal do not corroborate their claims. In the paper, I look at how lateralization can best be characterized. Specifically, I ask whether its domain is best treated via a syntax-based (Nespor & Vogel 1986, Selkirk 1984) or an intonation-based approach (Pierrehumbert 1980, Jun 1993) to prosodic structure. Based on nasal airflow data as a means of monitoring velum activity coincident with a nasal stop in an *l-n* sequence, combined with pitch tracks to define an accentual phrase, I argue that lateralization is neither an utterance-span rule nor a syntax-based rule. Sentences recorded with a potential environment for lateralization show that lateralization occurs within an accentual phrase but is blocked between accentual phrase boundaries. When intonation-based and syntax-based models disagree about phrase boundaries, lateralization only occurs where the intonation-based model predicts it will. This indicates that lateralization is best defined as an accentual phenomenon, being sensitive to the accentual phrase. This finding lends further support to an intonation-based model for Korean prosodic structure (Jun 1993).

Keywords: Lateralization, Korean Prosodic Structure, Accentual Phrase, Nasal Airflow

1. Introduction

This paper focuses on the phenomenon of lateralization in Korean. In particular, I will examine how to best characterize the domain of lateralization in Korean. In §2, I briefly review the prosodic structure in Korean. In §3, I describe the nature of lateralization in *l-n* sequences. In §4, I motivate a prosodic approach to the application of lateralization by providing aerodynamic data which show that lateralization is not an utterance-span rule, a conclusion which argues against the claims of previous studies (Han 1993, Park 1990). In §5, I present aerodynamic and acoustic data, and use those data to show that syntax-based accounts of lateralization do not adequately account for the facts. Specifically, I

* School of Liberal Arts, Kyungsoong University

examine how syntax-based and intonation-based models project their phrase boundaries with respect to *l-n* sequences, and show that lateralization only occurs within accentual phrases. Finally in §6, I conclude that an intonation-based approach to prosodic structure best characterizes the domain of application of lateralization in Korean.

2. Prosodic Structure

A general assumption regarding speech is that utterances can be broken down into smaller phrasal constituents that are hierarchically organized. Prosody refers to this phrasal organization of speech. Much recent work in phonological research is devoted to the role that the phrasal structure of an utterance plays in forming the domain of application of phonological rules. In broad strokes, approaches to defining phrasal constituent have been either syntactically based (Nespor & Vogel 1986; Selkirk 1984, 1986) or intonationally based (Beckman & Pierrehumbert 1986; Jun 1993, 1998; Pierrehumbert & Beckman 1988). Syntax-based phrasing assumes that utterances are comprised of prosodic constituents projected from syntactic structure. It thus builds independent prosodic constituents on the basis of the edges of lexical or phrasal categories (End-based theory, Selkirk 1986) or the relation between a head and its complements (Relation-based theory, Nespor & Vogel 1986). On the other hand, intonation-based phrasing defines prosodic units larger than a word on the basis of surface phonetic properties (i.e. intonation and final lengthening). The former focuses on how to predict a prosodic boundary by looking at the syntactic structure in a given sentence, while the latter concentrate on how to detect a prosodic boundary in produced sentences (Jun 1998:190).

According to Jun (1993, 1998), the accentual phrase is located between a prosodic word and an intonational phrase, and has the underlying tonal pattern of LHLH or HHLH wherein the laryngeal feature of the phrase-initial segment determines the accentual phrase-initial tone. All of the underlying tones are realized on the surface when an accentual phrase has more than four syllables. But when it has fewer than four syllables, a few different surface tonal patterns are realized depending on the degree of undershoot of the initial H or the following L tones.

3. Interaction between laterals and nasals

In a sequence containing a coronal nasal *n* and a lateral *l* in Korean, the nasal

consonant loses its nasality, assimilating to the adjacent lateral. This assimilation rule is called Lateralization, examples of which are given in (1). Note “-” indicates a boundary of bound root.

- | | | | |
|--------|-------------|------------|---------------------|
| (1) a. | / san-lim / | [sallim] | ‘forest’ |
| | / hon-lan / | [hollan] | ‘confusion / chaos’ |
| b. | / sil-ne / | [sillæ] | ‘indoor’ |
| | / tʃal-na / | [tʃalla] | ‘moment’ |

Descriptively, lateralization applies across the boundaries of bound root compounds anticipatorily in (1a) and perseveratively in (1b). In understanding lateralization, it is necessary to discuss the underlying phonemic representation of the *n* and *l* alternation. In the Korean inventory, *l* and *n* are separate phonemes, as the minimal pairs in (2) illustrate.

- | | | | |
|--------|-----|---------|----------------|
| (2) a. | san | [san] | ‘mountain’ |
| b. | sal | [sal] | ‘flesh / skin’ |

However, the *l* and *n* distinction is neutralized in some contexts, as seen in the following data:

- | | | | |
|-----|-------------|------------|----------|
| (3) | / san-lim / | [sallim] | ‘forest’ |
| | / san-so / | [sanso] | ‘grave’ |

In (3) *san* in *san-lim* is the same morpheme as *san* in *san-so* they have the same meaning ‘mountain’. However, *san* exhibits an alternation: [sal] in *san-lim*, but [san] in *san-so*. Specifically, the allophone [l] occurs predictably before another [l], while [n] appears in other contexts such as before coronals, but never occurs before [l].

Lateralization also applies across the boundaries of free stem compounds. But in this case the directionality of the rule is fixed; that is, it is not a mirror image rule. Instead of anticipatory lateralization by which the preceding *n* changes into *l*, another rule of Delateralization which changes the following *l* into *n* occurs. Examples of lateralization and delateralization across the boundaries of free stem compounds are shown in (4). Note that “+” indicates a boundary of a free stem.

- | | | | |
|--------|--|--------------|--------------------------|
| (4) a. | <i>Lateralization across the boundaries of free stem compounds in l-n sequences.</i> | | |
| | / pul / + / noli / | [pullori] | ‘fire+game → fireworks’ |
| | / mul / + / nanli / | [mullalli] | ‘water+disaster → flood’ |

b. *Delateralization in n-l sequences*

/ tʃəŋsin / +/ lotoŋ /	[tʃəŋʃinnodoŋ]	‘mental work’
/ tʃikkʷən / +/ lamyoŋ /	[tʃikkʷənnamyoŋ]	‘abuse of power’

It is assumed that in Korean bound root compounds such as *hon-lan* ‘confusion’ and *sil-ne* ‘indoor’ in (1) constitute prosodic words and that the two members of bound root compounds or of stem compounds such as *tʃəŋsin + lotoŋ* ‘mental work’ in (4) constitute two separate prosodic words (Kang 1992).

According to Han (1993) and Park (1990), lateralization even occurs in constituents bigger than prosodic words in *l-n* sequences, as shown in (5).

(5) *Lateralization*

a. ne-ka	ka-l	nala		b. ki	pap-il	nuka	mək-əs-ni
I-NOM	go-COMP	country		the	rice-ACC	who	eat-PST-Q
‘the country to which I will go’				‘Who ate the rice?’			
[næga kal lara]				[ki pabil luga mægənni]			

However, lateralization does not occur across prosodic words in *n-l* sequences. Instead, delateralization occurs, as shown in (6).

(6) *Delateralization*

na-nin	leil	t’əna-n-ta	[nanin neil t’ənanda]
I-NOM	tomorrow	leave-FUT-DEC	
‘I am leaving tomorrow.’			

To account for the interaction between these two rules, Park (1990) splits their application into two different levels and further assumes that syllabification takes place at the end of the word cycle. On the other hand, Han (1993) considers delateralization as a syllable-onset rule rather than a rule that applies between prosodic words. Based on this assumption, she argues that delateralization is bound by the domain of the prosodic word, whereas lateralization is prosodically unrestricted: that is, delateralization is a prosodic word-span rule whereas lateralization is an utterance-span rule.

In order to fully understand the interaction between lateralization and delateralization, we need to correctly characterize the domains in which the rules apply. In particular, the focus of my investigation here is Han’s claim that lateralization is prosodically unrestricted. I show that contrary to Han’s claim, lateralization is not an utterance-span rule, rather a prosodically-governed rule. Specifically, lateralization is best characterized

as an accen-tual rule by the intonation-based model of Korean prosody.

4. Experiment 1: Testing Lateralization as an Utterance-Span Rule

4.1 Predictions of Han's examples

In the first experiment, I investigate whether lateralization is an utterance-span rule, as previously proposed (Park 1990, Han 1993), or whether lateralization is prosodically governed in any way. If lateralization is a prosodically unrestricted utterance level rule, we would expect lateralization to occur in all *I-n* sequences as the examples in (7) (Han 1993:161).

- | | | |
|---|--|---|
| (7) a. ne-ka ka-l nala
I-NOM go-COMP country
'the country to which I will go' | | b. ki pap-il nuka mək-əs-ni
the rice-ACC who eat-PST-Q
'Who ate the rice?' |
|---|--|---|

In phrase (7a), lateralization would apply between the complex NP, *nala* 'the country', and the modifying clause, *neka kal* 'to which I will go'. Sentence (7b) fundamentally led Han to conclude that lateralization is prosodically unrestricted, since the rule applies across the extraposed object, *ki papil*, and IP (=sentence), *nuka məkəsni*. If lateralization occurs in both sentences, we should not obtain any nasality correlated to velum lowering in the either of *I-n* sequences. That is, the initial /n/ of /nala/ and /nuka/ should surface as [l].

4.2 Aerodynamic Data

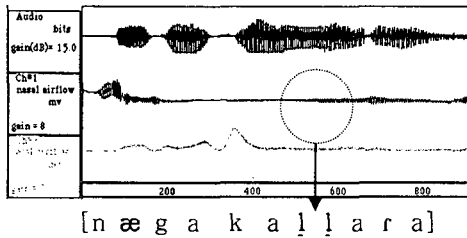
To verify Han's claim, aerodynamic data were collected. Six subjects (four females F1, F2, F3, F4 and two males M1, M2) who speak the Seoul dialect took part in the experiment. All of them were born and raised in Seoul. F1, F2 and M1 are in their mid-twenties, and F3, F4 and M2 are in their thirties. The sentences in (7) were given to them in Korean and randomized with five other dummy sentences. Subjects were asked to read each sentence without pausing to inhale. This was to prevent speakers from generating intonational phrases accidentally in the middle of sentences due to long pauses. However, when they breathed or paused within sentences, they were not asked to repeat sentences because I considered that was their normal speech pattern. A total of 120 tokens (6 subjects * 2 sentences * 10 repetitions) were collected. The presence (i.e. a rise and the increased energy of nasal flow) or the absence of nasal activity corresponding to the underlying nasal was observed.

4.3 Results and Implications

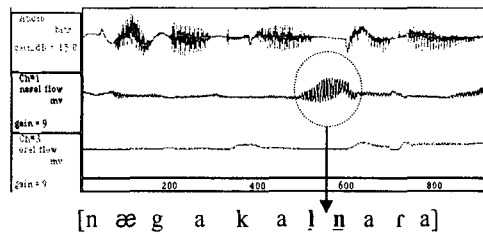
Interestingly, my aerodynamic data of Han's examples do not exactly corroborate her claim. For sentence, (7a), *neka kal nala* 'the country to which I will go', 49 out of 60 tokens (6 subjects * 10 repetitions) do not show any nasal activity corresponding the underlying /n/. This indicates that lateralization occurs in the *l-n* sequence, which is exemplified by representative nasal and oral traces from F1 in Figure (1a). The remaining 11 tokens of the data, attributed virtually to one speaker (F2), display nasal activity coincident with the underlying /n/. This contradicts Han's claim that lateralization should occur in any *l-n* sequences. As demonstrated in Figure (1b), a rise in the nasal flow trace and the presence of increased energy reflecting nasal resonance (marked by the circle) indicate the presence of a nasal stop. That is, there is no lateralization of the underlying /n/ in this token.

Figure 1. Nasal and oral traces of *neka kal nala* 'the country to which I will go'

a. F1: no nasal activity observed



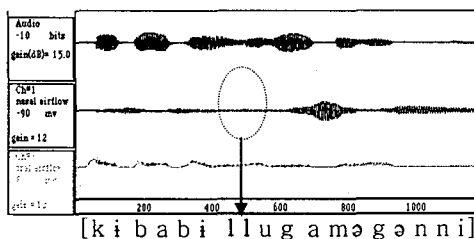
b. F2: nasal activity observed



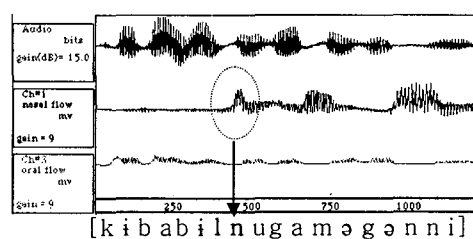
On the other hand, sentence (7b), *ki papil nuka məkəsni* 'Who ate the rice?', shows a somewhat different result. Lateralization is observed in only 16 out of 60 tokens recorded, which are attributable to two speakers, F3 and M2. The other 44 tokens show nasal activity (i.e. a rise in the nasal flow trace and the presence of increased energy) corresponding to the underlying /n/, indicating that lateralization does not apply in the *l-n* sequence. This is illustrated by representative nasal and oral traces from M2 and M1 in Figure (2a & b), respectively.

Figure 2. Nasal and oral traces of *ki papil nuka məkəsni* 'Who ate the rice?'

a. M2: lateralization applied



b. M1: lateralization NOT applied



The flatness of the nasal airflow trace in Figure (2a) indicates that lateralization has occurred. In contrast, nasal activity in Figure (2b) shows that lateralization has not occurred. Han claims that lateralization is prosodically unrestricted since the rule applies across the extraposed object and IP (=sentence) in the sentence, but Figure (2b) contradicts this. As we see in Figure 1 & 2, the presence and absence of nasal activity in the nasal airflow trace is robust. In this respect, we can make a simple “yes / no” judgment regarding the presence or absence of lateralization. The following table shows the number of tokens where lateralization is present and where lateralization is absent for sentences recorded.

Table 1. Number of tokens in which lateralization is present/absent

Subjects	<i>neka kal nala</i> 'the country to which I will go'		<i>ki papil nuka məkəsni?</i> 'Who ate the rice?'	
	No LAT	LAT	No LAT	LAT
<i>F1</i>		10	10	
<i>F2</i>	10		10	
<i>F3</i>		10	4	6
<i>F4</i>		10	10	
<i>M1</i>		10	10	
<i>M2</i>	1	9		10
<i>Total</i>	<i>11</i>	<i>49</i>	<i>44</i>	<i>16</i>

Several observations about the application of lateralization from Table 1 can be made. First, the two sentences appear to pattern in opposing ways with respect to lateralization: lateralization is present in 49 out of 60 tokens in the first sentence, but is present in only 16 tokens in the second sentence. This is due to the different phrasings of the sentences. Second, the application of lateralization is consistent *within* speakers. With the exception of F3 in the second sentence, all the speakers show the same pattern for each sentence. That is, speakers either do it one way or another. Third, the application of lateralization varies *across* speakers. F2 behaves differently in the first sentence, and F3 & M2 in the second sentence.

What Table 1 clearly shows is that Han’s claim is not well motivated and that lateralization is not an utterance-span rule. If it were, we would expect it to occur for all subjects in both sentences. It does not. If lateralization is not an utterance-span rule, what is the domain of lateralization? Specifically, we need to ask whether its prosodic domain is best characterized via a syntax-based or an intonation-based approach to prosodic structure.

5. Experiment 2: Lateralization as an Accentual Phrase Rule

To investigate how lateralization can be best characterized, i.e. by syntax-based or intonation-based phrasing, another experiment was performed. In §5.1, I describe the procedure of the experiment. In §5.2, I look at a case where an *l-n* sequence is projected to be within the same phrase by different models. In §5.3, I investigate a case where different models predict a phrase boundary between *l* and *n*. In §5.4, I examine where syntax-based and intonation-based models disagree about phrase boundaries and show that the intonation-based model can properly capture the domain of the application of lateralization.

5.1 Stimuli

Nine phrases or sentences which have an *l-n* sequence with various syntactic structures were designed, in addition to Han's examples. Since the application of lateralization in *n-l* sequences is restricted to the prosodic word, only *n-l* sequences are tested. The list of sentences is given in Appendix. Due to the space restriction, I demonstrate a representative example in the following sections.

The same subjects (four females F1, F2, F3, F4 and two males M1, M2) who participated in the first experiment participated in the second. A list of randomly ordered sentences in Korean on a print-out was given to each subject. Each sentence was recorded 10 times, totaling 540 tokens (6 subjects* 9 sentence types* 10 repetitions). The phrasings were not controlled: subjects were simply asked to read at a comfortable speaking rate. In this experiment, nasal activity in the flow trace, along with the pitch track for sentences, is examined. I determined phrasing based on pitch tracks. The presence or absence of nasal activity in terms of the location of the *l-n* sequence in the accentual phrase is investigated.

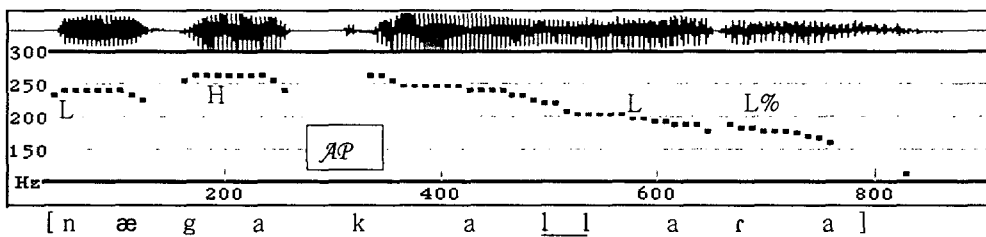
5.2 *l-n* sequences within the same phonological or accentual phrase

Let us begin with a sentence (8) where different models make the same prediction in phrasing with respect to the *l-n* sequence. The phrasings of the sentence by the different models are also presented.

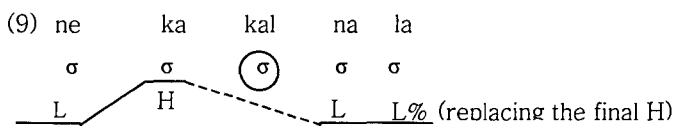
(8)		neka		kal		nala
a. End-based phrasing:	[PP]	[PP]
b. Relation-based phrasing:	[PP]	[PP]
c. Intonation-based phrasing:	[AP]

The end-based phrasing in (8a) predicts two phonological phrases by aligning their boundaries with the left ends of maximal projections, NP *neka* and VP *kal*. The relation-based phrasing in (8b) predicts the same phrasing as the end-based model, i.e. two phonological boundaries, [neka] [kal nala]. The verb *kal* combines with the adjacent N *nala* on its nonrecursive side and the NP *neka* forms its own phonological phrase. However, the common phrasing in (8c) produced by the subjects is different from the prediction of the syntactic models. As demonstrated in Figure 3, the entire phrase is produced within an accentual phrase by all speakers but F2.

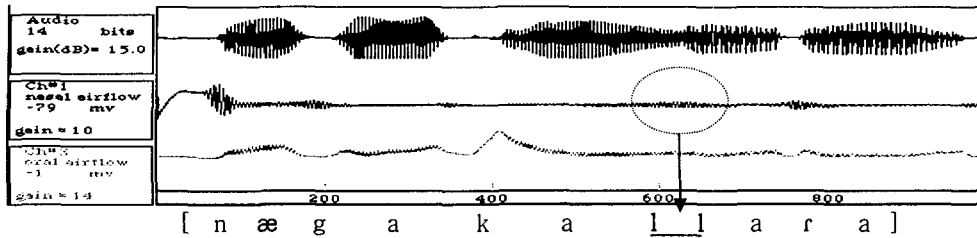
Figure 3. Pitch track of *neka kal nala* 'the country to which I will go' (F1)



As explained in the previous chapter, the accentual phrase is characterized by the tones of LHLH (or HLHL). All of the tones are realized on the surface when an accentual phrase has more than four syllables, while some of them (i.e. the initial H, L or HL) do not surface when it has fewer than four syllables. When an accentual phrase is longer than four syllables, the syllables between the third and the antepenult of the accentual phrase get their surface tones by interpolating the H on the second syllable and the L tone on the penult syllable (Jun 1998:194). The accentual phrase containing six syllables in Figure 3 is expected to have the following schematic tonal mapping:



The underlying tones of an accentual phrase (LHLH) are mapped from each edge. The middle syllable *kal* (circled) which is not assigned to any underlying tone gets its surface tone by interpolating the adjacent H and L tones. The final H tone of the accentual phrase is replaced by the boundary tone (L%) of the intonational phrase. The following is the nasal and oral airflow traces of the sentence, corresponding to the pitch track of F3 in Figure 3.

Figure 4. Nasal and oral traces of *neka kal nala* 'the country to which I will go' (F3)

Here we do not observe any nasal activity corresponding to the underlying nasal, indicating that lateralization occurs in the *l-n* sequence. Table 2 shows the number of tokens in which lateralization is absent and where lateralization is present for the sentence *neka kal nala* in (8) in which the *l-n* sequence is located within the same phrase by different models.

Table 2. Number of tokens where lateralization is present/absent for sentence (8) where the *l-n* sequence is predicted or produced within the same phonological or accentual phrase

Subject	Sentence	<i>neka kal nala</i> 'the country to which I will go'	
		<i>No Lateralization</i>	<i>Lateralization</i>
<i>F1</i>			10
<i>F2</i>		10	
<i>F3</i>			10
<i>F4</i>			10
<i>M1</i>			10
<i>M2</i>		1	9
<i>Total</i>		11	49

As Table 2 illustrates, if F2 is excluded, lateralization occurs in almost all the tokens produced by the speakers, and patterns in the same way across speakers. Within speakers, the pattern of lateralization is consistent.

So, where an *l-n* sequence is predicted to be within the same phonological phrase by the syntax-based models or the same accentual phrase by the intonation-based model, we do not observe any nasal activity corresponding to /n/, thus indicating that lateralization does occur.

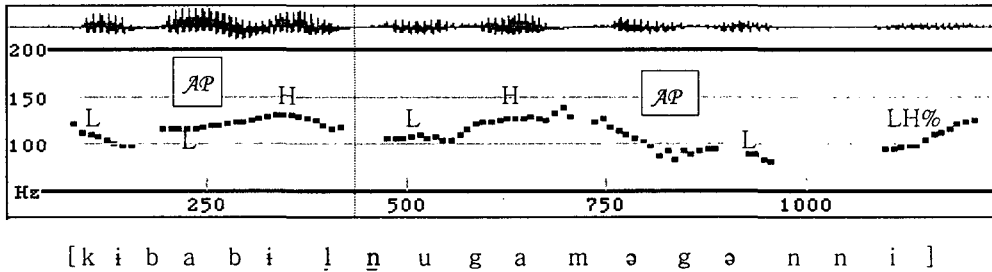
5.3 *l-n* sequences separated by the phonological or accentual phrase boundary

Next, consider (10) where the different models predict a phrase boundary between *l* and *n*.

- (10)
- | | | | | |
|-------------------------------|-----------------------------|-------------|----------------------|----------------|
| | <i>ki papil_i</i> | <i>nuka</i> | <i>t_i</i> | <i>məkəsni</i> |
| a. End-based phrasing: | [PP] | [PP] | [PP] | |
| b. Relation-based phrasing: | [PP] | [PP] | [PP] | |
| c. Intonation-based phrasing: | [AP] | | AP | |

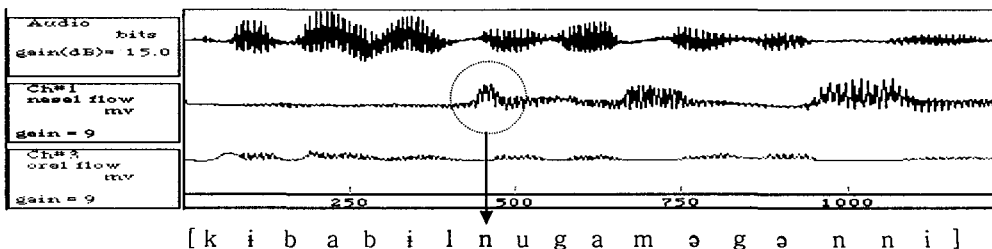
The different models make the same predictions here. End-based phrasing produces three phonological phrases, [*ki papil*] [*nuka*] [*məkəsni*]. The intonation-based phrasing in (10c) produces two accentual phrases: [*ki papil*] [*nuka məkəsni*]. The phrasing in (10c) is exemplified by representative pitch track from M1 in Figure 5.

Figure 5. Pitch track of *ki papil nuka məkəsni*? ‘Who ate the rice?’ (M1)



The rising tone (LH) mapped to the prosodic word *papil* [*babil*] functions as a demarcator for an accentual phrase boundary, separating *l* and *n* into different accentual phrases. According to Jun (1993), some syntactic frames strongly affect accentual phrasing, even though the actual phrasing of a given sentence can vary from what we predict. For example, an accentual phrase boundary is most likely to occur between an extracted object and IP. This constraint leads all the speakers (except M2) to produce an accentual phrase boundary between the extraposed object, *ki papil*, and IP, *nuka məkəsni* for the sentence. Figure 6 shows the nasal and oral traces of the sentence by this phrasing.

Figure 6. Nasal and oral traces of *ki papil nuka məkəsni*? ‘Who ate the rice?’ (M1)



A rise in nasal flow and the presence of increased energy reflecting nasal resonance corresponding to the underlying /n/ suggests that lateralization does not occur.

Table 3 shows the number of tokens in which lateralization is absent or present for sentence discussed, (10), in which the *l-n* sequence is separated by different models.

Table 3. Number of tokens where lateralization is present or absent for sentences (10) where the *l-n* sequence is separated by different models

Sentence Subject	<i>ki papil nuka məkəsni 'Who ate the rice?'</i>	
	<i>No Lateralization</i>	<i>Lateralization</i>
<i>F1</i>	10	
<i>F2</i>	10	
<i>F3</i>	4	6
<i>F4</i>	10	
<i>M1</i>	10	
<i>M2</i>		10
<i>Total</i>	<i>44</i>	<i>16</i>

As we observe in Table 3, lateralization does not occur to a significant degree at the boundary of either phonological or accentual phrase. This dramatically shows that lateralization is not an utterance-span rule, a finding that contradicts Han's claim. More importantly, it suggests the significance of the prosodic effect in the study of lateralization. That is, where a phrase boundary is either predicted across an *l-n* sequence by the syntax-based models or detected by the intonation-based model, we observe nasal activity corresponding to /n/, thus indicating that lateralization does not occur. The question to be addressed is what it happens if we have different phonological and accentual phrasing with respect to *l-n* sequences. I discuss this in the following section.

5.4 *l-n* sequences separated by the accentual phrase boundary only

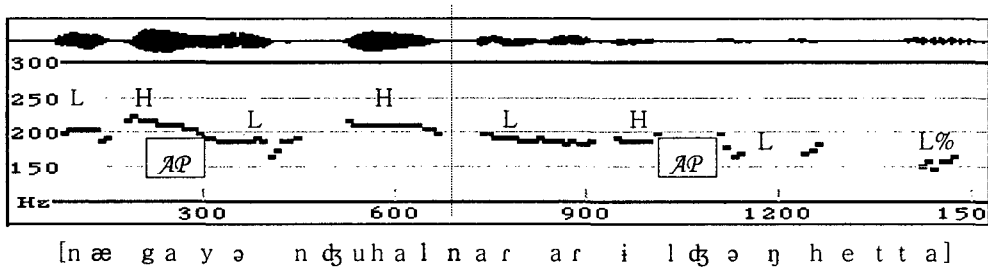
Let us consider the case (11) where different models project different phrasings. Phrasings of the sentence by the syntax-based models and by the intonation-based model are presented in (12).

- (11) ne-ka yəntfu-ha-l nala-lil tʃəŋhe-s-ta
 I-NOM concert-perform-COMP country-ACC decide-PST-DEC
 'I decided in which country I would perform the concert.'

- (12) neka yəntfuhal nalalil tʃəŋhesta
 a. End-based: [PP] [PP] [PP]
 b. Relation-based: [PP] [PP] [PP]
 c. Intonation-based: [AP] [AP]

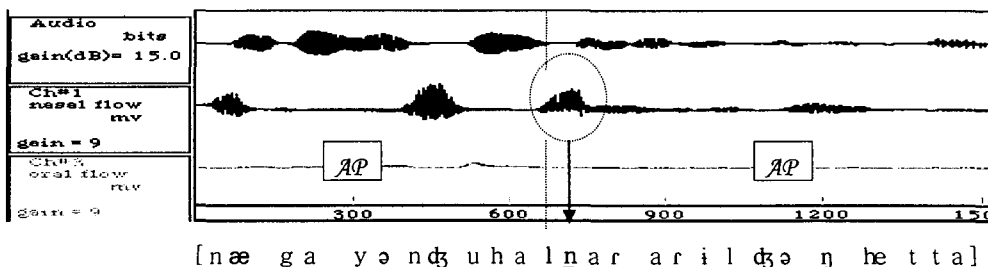
As we can see in (12), the syntax-based models and the intonation-based model disagree about phrase boundaries. End-based phrasing produces two phonological phrases, [neka] [yəncuhal nalalil tʃəŋhesta], by aligning their boundaries with the ends of maximal projections (NP₁ and IP₂); then, the second major phrase is broken down into two pieces by binary branching, yielding [neka] [yəncuhal nalalil] [tʃəŋhesta], as seen in (12a). The relation-based phrasing in (12b) would mark a boundary at the left edge of non-branching IP₂, which forms a phonological phrase together with the following N; then unphrased words form phonological words of their own, yielding the same phrasing as the end-based phrasing. On the other hand, the intonation-based phrasing in (12c) produces different phrasings from the syntax-based phrasing. The most common phrasing is, [neka yəncuhal] [nalalil tʃəŋhesta], which is exemplified by a representative pitch track from F2 in Figure 7.

Figure 7. Pitch track of neka yəntʃuhal nalalil tʃəŋhesta (F2)



In Figure 7, the rising pitch (LH) functions as a demarcator for the accentual phrase boundary, splitting the *l-n* sequence into different phrasing units. Note that for this sentence both syntax-based models predict lateralization since *l* and *n* are adjacent within a phonological phrase, while the intonation-based model does not. The nasal airflow trace in Figure 8 demonstrates that lateralization does not occur in the sentence: nasal activity corresponding to the underlying nasal is obtained.

Figure 8. Nasal and oral traces of neka yəncuhal nalalil tʃəŋhesta (F2)



In Figure 8, *n* in *nala* does not undergo lateralization when it follows *l* in *yəntʃuhal*, because these words are divided into separate phrasing groups. This is not predicted by either of syntax-based models, but it is predicted under the intonation-based model. Table 4 shows the number of tokens where lateralization is present (i.e. no nasal activity) and where lateralization is absent for sentence (11).

Table 4. Number of tokens where lateralization is present / absent for sentence (11) where the *l-n* sequence is separated only by the intonation-based model

Subjects	Sentences	
	<i>neka yəncuhal nalalil cəghesta</i> 'I decided in which country I would perform the concert.'	
	<i>No Lateralization</i>	<i>Lateralization</i>
<i>F1</i>	8	2
<i>F2</i>	10	
<i>F3</i>	10	
<i>F4</i>	9	1
<i>M1</i>	8	2
<i>M2</i>	10	0
<i>Total</i>	<i>55</i>	<i>5</i>

In Table 4, we observe that lateralization is dramatically absent in the *l-n* sequence which is predicted to be within the same phonological phrase by the syntax-based models, but to be separated into different accentual phrases by the intonation-based model. Nasal activity indicative of non-application of lateralization in the *l-n* sequence, is obtained in considerable proportions: 55 out of 60 tokens. The application of lateralization in general is consistent within and across speakers.

Crucially, the sentence above, where different models predict different phrasings teases apart the syntax-based models from the intonation-based model, and clearly it demonstrates that lateralization is better characterized by the intonation-based model. That is, when the intonation-based and syntax-based models disagree about phrase boundaries, lateralization only occurs where the intonation-based model predicts it will. Lateralization occurs within the accentual phrase and it is blocked across the accentual phrase boundary. Thus, lateralization is not a syntax-based rule, but an intonation-based rule sensitive to the accentual phrase.

6. Conclusion

In this paper, I have looked at how lateralization can be prosodically defined. In particular, I have argued that the domain of lateralization has not been adequately

characterized: lateralization, as an utterance-span rule, has been considered to apply across the sentence. However, by using the nasal airflow data combined with pitch tracks, I have argued that lateralization is neither an utterance-span rule nor a syntax-based rule. Rather, lateralization is best characterized as an accentual phenomenon, being sensitive to the accentual phrase. Specifically, lateralization occurs only within an accentual phrase.

Appendix

<p>a. param cal nal əp-ta wind calm day there is not-DEC 'There is never a day when the wind is calm.' (literally) 'There is never a day without any concerns.' (idiomatic meaning)</p>	<p>f. temun-il nuka tutilyə-s-ta door-ACC who knock-PST-DEC 'Someone knocked at the door.'</p>
<p>b. ne-ka ka-l nala I-NOM go-COMP country 'the country to which I will go'</p>	<p>g. kacoktil-il nuka tolpol kəs inka family-ACC who take care of will 'Who is going to take care of the family?'</p>
<p>c. aki-lil nah-ta baby give birth-DEC 'She gave birth to a baby.'</p>	<p>h. sənmul-il nə-hant^he tʃu-kes-ta present-ACC you-to give-FUT-DEC 'I will give you a present.'</p>
<p>d. ki-ka ciyilil namyoŋhe-s-ta he-NOM power abuse-PST-DEC 'He abuses his power.'</p>	<p>i. apəci-k'esə yosai tʃəŋmal nilkəpoi-sin-ta father-HON recently pretty look old-HON-DEC 'Father is looking pretty old recently.'</p>
<p>e. ki pap-il nuka mək-əs-ni the rice-ACC who eat-PST-Q 'She gave birth to a baby.'</p>	<p>j. ne-ka yəncu-ha-l nala-lil tʃəhe-s-ta I-NOM concert-perform-COMP country-ACC decide-PST-DEC 'I decided in which country I would perform the concert.'</p>

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▲ Soojung Kim

School of Liberal Arts, Kyungsung University
110-1 Daeyeon-dong Nam-gu, Busan 608-736, Korea
Tel: +82-51-620-4239
E-mail: sjkim@star.ks.ac.kr